

Report No. UT-19.26

Investigation of Utah Highway Speed-Limit Compliance Rates and Evaluation of Speed-Limit Design in Towns along Highways

Prepared For:

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**Final Report
December 2019**

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ACKNOWLEDGMENTS

The authors would like to acknowledge the Utah Department of Transportation (UDOT) for funding this research, and the following individuals from UDOT serving on the Technical Advisory Committee (TAC) for helping to guide the research:

- Jesse Sweeten (UDOT)
- Vincent Liu (UDOT)
- Kelly Njord (UDOT)

TECHNICAL REPORT ABSTRACT

1. Report No. UT-19.26		2. Government Accession No. N/A		3. Recipient's Catalog No. N/A	
4. Title and Subtitle Investigation of Utah Highway Speed-Limit Compliance Rates and Evaluation of Speed-Limit Design in Towns along Highways				5. Report Date June 2019	
				6. Performing Organization Code	
7. Author(s) Zhao Zhang, Xianfeng Terry Yang, Cathy Liu, Yun Yuan				8. Performing Organization Report	
9. Performing Organization Name and Address University of Utah Department of Civil & Environmental Engineering 110 Central Campus Drive, Suite 2000 Salt Lake City, UT 84112				10. Work Unit No. 5H08259H	
				11. Contract or Grant No. 18-8670	
12. Sponsoring Agency Name and Address Utah Department of Transportation 4501 South 2700 West P.O. Box 148410 Salt Lake City, UT 84114-8410				13. Type of Report & Period Covered Final Feb 2013 to Feb 2015	
				14. Sponsoring Agency Code PIC No. AM17.20	
15. Supplementary Notes Prepared in cooperation with the Utah Department of Transportation.					
16. Abstract <p>In Utah, 14,546 speed-related crashes occurred in rural areas from 2010. 47.4% of them were crashes with injuries. 239 crashes resulted in fatalities and, 1,043 crashes resulted in serious injuries. This shows a crucial need for investigating highway speed-limit compliance rates and evaluating current practices on setting up speed zones in towns along highways in Utah. In this project, our research team applied USLIMITS2 to obtain the appropriate maximum speed limit for studied road segments of small cities and towns in Utah using the collected data. USLIMITS2 employs a decision algorithm to advise the user of the appropriate maximum speed limit for the specific road section of interest. Different data sources are utilized for this research, such as the iPeMS database, the Utah Vehicle Collisions Database, etc. USLIMITS2 is implemented for 38 small cities and towns in Utah. The recommended speed limit of 46 locations of these small cities and towns is higher than the existing speed limit. The recommended speed limit of 4 locations of these small cities and towns is lower than the existing speed limit. It can help transportation agencies find proper countermeasures to control the speed limit to fulfill zero fatalities in Utah.</p>					
17. Key Words Speed limit, State highway, Small towns, Compliance rate, 85 th percentile speed.		18. Distribution Statement Not restricted. Available through: UDOT Research Division 4501 South 2700 West P.O. Box 148410 Salt Lake City, UT 84114-8410 www.udot.utah.gov/go/research		23. Registrant's Seal N/A	
19. Security Classification (of this report) Unclassified	20. Security Classification (of this page) Unclassified	21. No. of Pages 87	22. Price N/A		

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LIST OF ACRONYMS

AADT	Annual Average Daily Traffic
ATSPM	Automated Traffic Signal Performance Measures
FHWA	Federal Highway Administration
NHTSA	National Highway Transportation Safety Administration
UDOT	Utah Department of Transportation

EXECUTIVE SUMMARY

During the past decades, the numbers of traffic accidents and traffic fatalities in the U.S. have increased rapidly. Statistics from the NHTSA show that many road fatalities were caused by speeding. In addition to increasing the severity of crashes, high roadway speed also contributes to increasing the risk of vehicles being involved in traffic crashes. Thus, how to properly set speed limits on highways becomes a critical traffic safety issue. However, according to the literature, speed limit violations can reach levels of 40% to 50% on some state highways. This raises a crucial need for investigating highway speed-limit compliance rates in Utah. NHTSA data also show that a higher percentage of fatal crashes happened in rural areas and most of them are caused by speeding. Hence, traffic safety in those small towns along rural highways has become a major concern due to speed limit reduction within the towns. Therefore, the significant speed differentials may lead to a high risk of traffic crashes.

In this project, our research team applied the USLIMITS2, developed by the Federal Highway Administration (FHWA), to obtain the appropriate maximum speed limit for studied road segments with the collected data. USLIMITS2 employs a decision algorithm to advise the user of the appropriate maximum speed limit for the specific road section of interest. USLIMITS2 was developed based on input from a panel of experts in the USA that included traffic engineers, enforcement personnel, decision-makers, and researchers from different parts of the country. Our research team utilized different data sources (such as the iPeMS database, the Utah Vehicle Collisions Database, etc.) to retrieve target data as the inputs of the USLIMITS2. The study segment (start and end) and crash statistics (total crash / injured crash) were mainly collected from the Utah Vehicle Collisions Database.

The results revealed that transportation agencies should take action to control traffic speed when the highway 85th percentile speed at the entrances of small cities or towns is higher than 60 mph. It is recommended that the speed limit should be decreased at the entrances of small cities or towns in cases with low 85th percentile speed, high crash rate, and high AADT. It also shows that the speed limit could be increased, if necessary, at the entrances of small cities or towns with low AADT, high 85th percentile speed, and low crash rate.

1. INTRODUCTION

1.1 Problem Statement

During the past decades, the numbers of traffic accidents and traffic fatalities have increased rapidly in the U.S., and NHTSA statistics show that around 29% of road fatalities in 2017 were speed related (National Highway Traffic Safety Administration [NHTSA], 2019). In addition to increasing the severity of crashes, high roadway speed also contributes to increasing the risk of vehicles being involved in a traffic crash. Thus, how to properly set speed limits on highways has become a critical traffic safety issue and many state Departments of Transportation (DOTs) in the U.S. have developed speed-zone guidelines or manuals for this need. However, according to the literature, drivers are still reluctant to comply with speed limits, and statistics show that speed limit violations can reach levels of 40% to 50% on some highways. These percentages are extremely discouraging considering that higher speed-limit compliance rates would lead to a significant drop in fatalities and injuries in traffic crashes. In Utah, 14,546 speed-related crashes occurred in rural areas from 2010 (UDOT, 2019) and 47.4% of them involved injuries. Moreover, 239 crashes led to fatalities, and 1,043 crashes caused serious injuries. This raises a crucial need for investigating highway speed-limit compliance rates and evaluating current practices on setting up speed zones in towns along highways in Utah.

In the literature, many existing studies showed that the posted speed limit didn't significantly affect the total traffic crashes (Kockelman, 2006; Thornton et al., 1996). However, the increase of speed limit would increase the probability of injured or fatal crashes (Agent et al., 1998; Kockelman, 2006; Malyshkina et al., 2006; Mannering, 2006; Raju et al., 1998; Wisconsin Transportation Information Center, 1999; Zahabi et al., 2011). Malyshkina and Mannering proved that higher speed limits would increase the probability of injured and fatal crashes on non-interstate highways (Malyshkina et al., 2006). Zahabi et al. found that there is no specific relationship between crash rate and the increase of speed limit (Zahabi et al., 2011). Thornton et al. conducted a comprehensive freeway speed-limit study and found that a higher speed limit would trigger severe crashes, but the higher speed limit doesn't bring more crashes (Thornton et al., 1996).

Many state DOTs developed guidelines or manuals for setting speed limits on arterial roads (Arizona Department of Transportation, 2000; Florida Department of Transportation, 2010; Idaho Transportation Department, 1997; Montana Department of Transportation, 2007; North Carolina Department of Transportation, 1995; Texas Department of Transportation, 2015; Wisconsin Department of Transportation, 2009). Certain factors need to be considered for setting speed limits, including:

- Speed parameters: 85th percentile speed, 50th percentile speed
- Existing speed limit
- Length of section
- Alignment
- Crash record
- Traffic volume (AADT)
- Roadway characteristics
- Intersections
- Parking practices and pedestrian activity

In recent years, the Federal Highway Administration (FHWA) has developed an expert system to determine speed limits in speed zones (Srinivasan et al., 2006). The system is now available online as USLIMITS2 (Federal Highway Administration, 2019). It is a web-based tool designed to help practitioners set reasonable, safe, and consistent speed limits for specific segments of roads. USLIMITS2 is applicable to all types of roads ranging from rural local roads and residential streets to urban freeways.

1.2 Objectives

This project aims to address the need for UDOT to investigate highway speed-limit compliance conditions in Utah and evaluate current practices on setting up speed zones in towns along highways. Our research team at the University of Utah starts the research from the global aspect by examining overall speed-limit compliance rates in Utah and assessing current practices on setting up speed limits in towns. The study results will help UDOT to re-set the speed zones and add new countermeasures for improving compliance rates and traffic safety.

1.3 Scope

In this study, FHWA's web-based tool, USLIMITS2, is implemented for studying speed limit designs in small cities and towns of Utah. The key factors in USLIMITS2 include speed limit, 85th percentile speed, 50th percentile speed, study segment, annual average daily traffic (AADT), and crash statistics (total crash / injured crash), etc. Speed data are obtained from the iPeMS database and crash data are mainly collected from Utah Vehicle Collisions database.

1.4 Outline of Report

This report documents the findings of the research and proceeds with the following sections:

- Introduction
- Data Collection
- Research Methods
- Experimental Studies
- Results Analysis and Countermeasures
- Conclusions

2. DATA COLLECTION

2.1 Overview

Data including AADT, crash records, etc., are fundamental for implementing USLIMITS2. Therefore, for this project, we utilized different data sources (such as the iPeMS database, the Utah Vehicle Collisions Database, etc.) to retrieve target data for evaluating speed limit designs. Key factors in USLIMITS2 include speed limit, 85th percentile speed, 50th percentile speed, study segment, annual average daily traffic (AADT), and crash statistics (total crash / injured crash), etc. The speed data (e.g. speed limit, 85th percentile speed, 50th percentile speed) are obtained from the iPeMS database. The study segment (start and end stations) and crash statistics (total crash / injured crash) are mainly collected from the Utah Vehicle Collisions Database. Other related information is collected from other sources, for example, the geometry features are collected from Google Maps.

2.2 Data Sources for Study

The iPeMS Database and Utah Vehicle Collisions Database are mainly utilized in this project. Therefore, it is necessary to introduce how to retrieve data from these two databases for implementing studies.

2.2.1 iPeMS Database

Notably, despite the fact that Automated Traffic Signal Performance Measures (ATSPM) used by the UDOT Traffic Operation Center (TOC) can show real-time and historical functionality at signalized intersections, its data are not available for most entrance intersections of cities and towns. Hence, the required volume and speed data of this project were obtained from the iPeMS database which utilized probe data collected from vehicle navigation systems, cell phone applications, and fleet vehicles. The iPeMS database is able to provide traffic information (i.e., speed and flow rate) on most segments of state highways and freeways in Utah. **Figure 1** illustrates how to obtain speed limit and speed data from iPeMS. The speed limit of the selected road segment can be directly read from iPeMS. The AADT, 85th percentile speed, and

50th percentile speed can be calculated by traffic speed and flow data from iPeMS. Traffic speed and flow data can be also downloaded from iPeMS by specifying the time range.

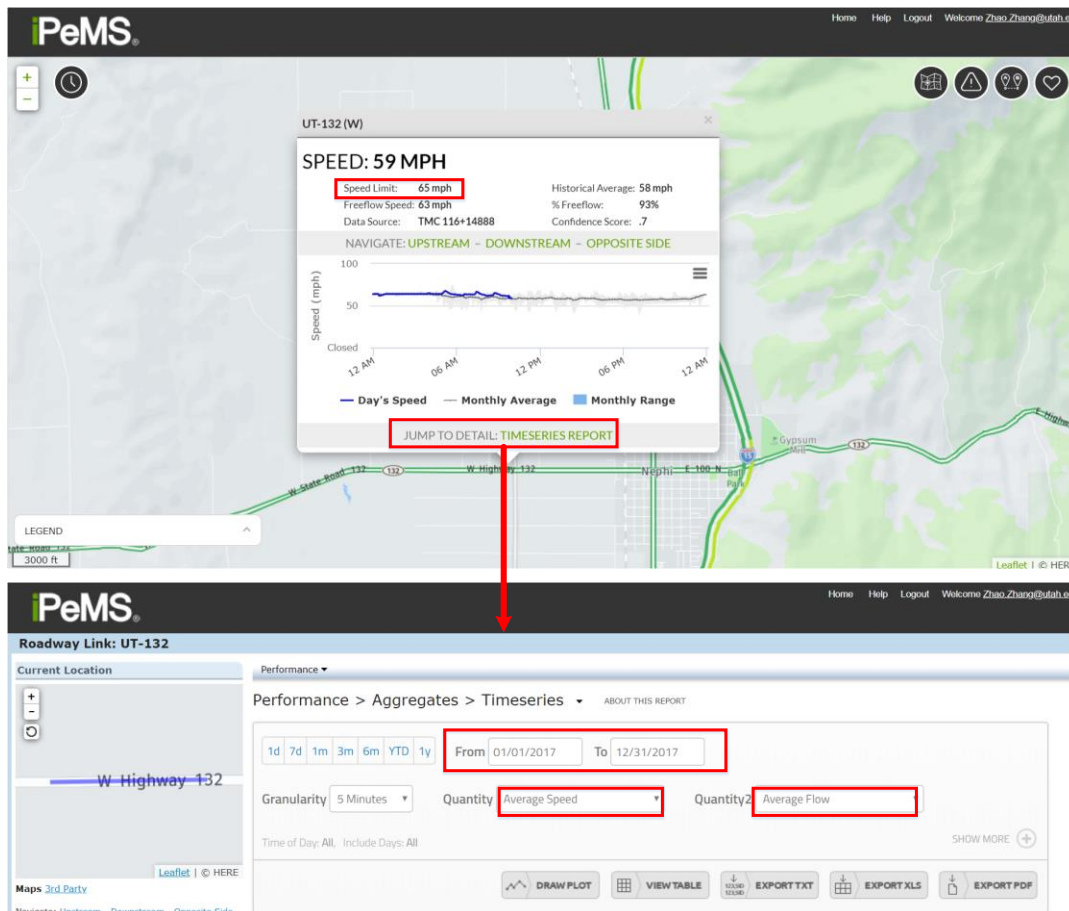


Figure 1 Illustration of retrieving data from iPeMS

2.2.2 Utah Vehicle Collisions Database

The Utah Vehicle Collisions Database is a map viewer depicting vehicle collisions in the state of Utah, as shown in **Figure 2**. The milepost is also shown on the map. Crash data can be visualized by specifying the time range and different injury levels (e.g., no injury, injury, and fatal.).

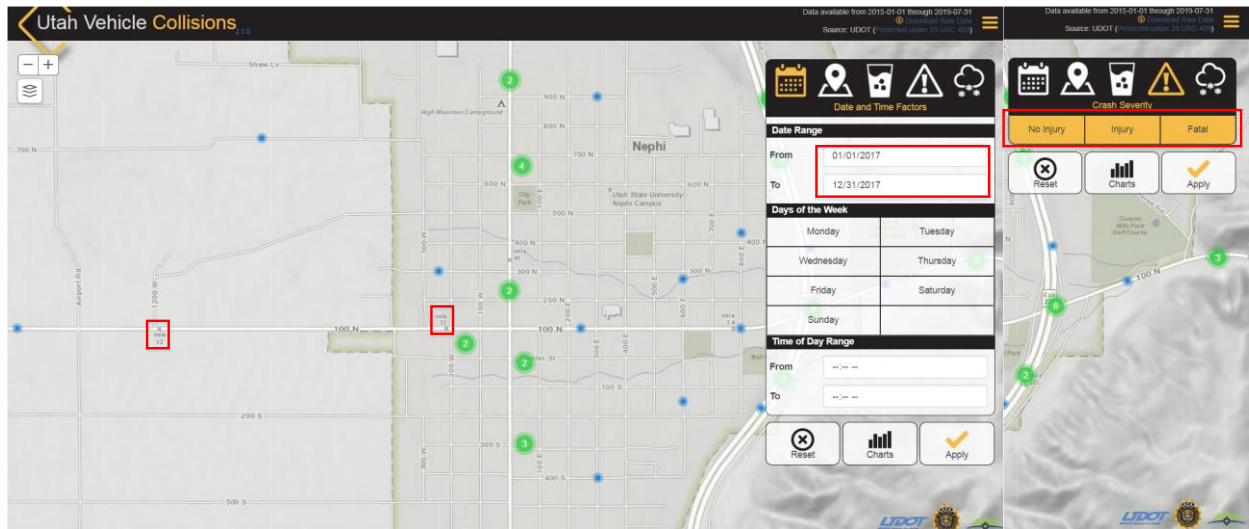


Figure 2 Illustration of retrieving data from the Utah Vehicle Collisions Database

3. RESEARCH METHODS

3.1 Preliminary Data Check

Based on the data sources, our research team first examined the data availability and speed limit change in small cities and towns in Utah. **Table 1** shows data availability and speed limit change information, and this project focused on studying small cities or towns that have reduced highway speed limits at their entrances. Notably, ATSPM data are not available for most interested locations. After the preliminary data screening, 37 small cities and towns with sufficient iPeMS data are selected for analyzing. The distribution map of examined small cities and towns is shown in **Figure 3** where the small cities and towns are indicated by yellow stars.

Table 1 Data availability for all small cities and towns along state highways in Utah

City/Town	State Highway	ATSPM data	iPeMS data	Speed limit change
Garden City	SR30	No detector	Yes	Only on SB SR30
Laketown	SR30	No detector	Yes	No
Randolph	SR16	No detector	Yes	Yes
Woodruff	SR16, SR39	No detector	Yes	Only on SR16
Clarkston	SR142	No detector	No	No
Smithfield	US91, SR218	No detector	Only for US91	No
North Logan	US89, US91	No data	Yes	No
Hyrum	SR165, SR101	No detector	No	No
Paradise	SR165	No detector	No	No
Mantua	US91	No detector	Yes	No
Honeyville	SR38, SR240	No detector	No	No
Tremonton	SR102	No detector	No	No
Fielding	SR81	No detector	No	No
Pleasant View	US89	No detector	Yes	No
Henefer	SR65, SR86	No detector	No	No
Grantsville	SR138, SR112	No detector	Yes	Only on SR 112
Tooele	SR36, SR112	No data	Yes	Yes
Park City	SR224, SR248	No detector	Yes	Only on SR 248
Stockton	SR36	No detector	Yes	Yes
Cedar Fort	SR73	No detector	Yes	Only on NB

Santaquin	US6, SR 198	No detector	Yes	Yes
Eureka	US6	No detector	Yes	Yes
Oakley	SR32	No detector	Yes	No
Kamas	SR32, SR150, SR248	No detector	Only for SR32	Only on NB
Heber City	US40 & SR113	No data	Only for US40	Only on NB
Tabiona	SR35	No detector	No	No
Duchesne	US40, SR311, US191, SR87	No detector	Only for US40 & US191	only on US40
Roosevelt	SR121, US40	No data	Only for US40	Only on EB US40
Vernal	SR121, US40, US191	No data	Only for US40 & US191	Only on WB US40
Delta	US50, US6	No detector	Yes	Only on US6 & EB US50
Nephi	SR132, SR28	No detector	Yes	Yes
Mona	SR54	No detector	No	No
Levan	SR78, SR28	No detector	Yes	Yes
Oak City	SR125	No detector	No	No
Scipio	US50	No detector	Yes	Only on NB US50
Holden	SR64	No detector	Yes	No
Fillmore	SR100, SR99	No detector	Only for SR99	No
Meadow	SR133	No detector	No	No
Kanosh	SR133	No detector	No	No
Beaver	SR21, SR 153	No detector	Only for SR21	Yes
Milford	SR257, SR21, SR129	No detector	Only for SR21 & SR257	Only on SR21 & SR257
Minersville	SR130	No detector	Yes	No
Parowan	SR271, SR143	No detector	Only for SR143	No
Cedar City	SR14, SR56	No detector	Yes	Yes
Paragonah	SR271	No detector	No	No
Enterprise	SR18, SR219	No detector	Only for SR18	No
Springdale	SR9	No detector	Yes	No
Hildale	SR59	No detector	Yes	Yes
Fairview	US89, SR31	No detector	Yes	only on NB US89
Moroni	SR116, SR132	No detector	Yes	Yes
Ephraim	US89	No detector	Yes	Yes

Manti	US89	No detector	Yes	Yes
Gunnison	US89, SR28, SR137	No detector	Only for US89 & SR28	Only EB US89 & SR28
Centerfield	US89	No detector	Yes	No
Salina	US89, US50, SR24	No detector	Yes	Only on WB US50
Richfield	SR118, SR119, SR120	SR 118 with no data	No	No
Elsinore	SR258, SR118	No detector	No	No
Monroe	SR118	No detector	No	No
Marysvale	US89	No detector	Yes	No
Junction	US89, SR153, SR62	No detector	Only on US89 & SR62	No
Panguitch	US89	No detector	Yes	No
Hatch	US89	No detector	Yes	No
Orderville	US89	No detector	Yes	No
Kanab	US89	No detector	Yes	Yes
Koosharem	SR62	No detector	Yes	Yes
Bicknell	SR24	No detector	Yes	Yes
Antimony	SR22	No detector	No	No
Escalante	SR12	No detector	Yes	Yes
Tropic	SR12	No detector	Yes	No
Henrieville	SR12	No detector	Yes	No
Helper	SR157, SR244	No detector	No	No
Price	SR10, SR55	No detector	Yes	No
East Carbon	SR123, SR124	No detector	No	No
Scofield	SR96	No detector	No	No
Cleveland	SR155	No detector	No	No
Huntington	SR10, SR31	No detector	Yes	Yes
Ferron	SR10	No detector	Yes	Yes
Emery	SR10	No detector	Yes	Yes
Green River	SR19	No detector	Yes	No
Moab	US191	No data	Yes	No
Monticello	US191, US491	No detector	Yes	Yes
Blanding	US191	No detector	Yes	Yes
Montezuma Creek	SR162, SR262	No detector	No	No



Figure 3 Distribution map of small cities and towns in Utah

3.2 USLIMITS2 Web-Based Tool

In this project, our research team applied USLIMITS2 to obtain the appropriate maximum speed limit at the studied road segments. USLIMITS2 employs a decision algorithm to advise the user of the appropriate maximum speed limit for the specific road section of interest. USLIMITS2 was developed based on input from a panel of experts in the USA that included traffic engineers, enforcement personnel, decision-makers, and researchers from different parts of the country. The expert system is accessed through the Internet and provides recommended speed limits for speed zones on all types of roadways from rural two-lane roads to urban freeway segments. The inputs for running USLIMITS2 are shown in **Table 2**. More detailed information about the procedure of implementing USLIMITS2 can be found in (Federal Highway Administration, 2019).

Table 2 Input variables for the USLIMITS2

USLIMITS2	
Input variables	85 th percentile speed
	50 th percentile speed
	Speed limit
	Adverse alignment
	Section length
	Annual Average Daily Traffic (AADT)
	Number of unsignalized intersections
	Number of signalized intersections
	Total crashes
	Injured crashes

4. EXPERIMENTAL STUDIES

4.1 Overview

Based on the results of preliminary data analysis, our research team implemented the USLIMITS2 to assess the speed limit design of 37 small cities or towns in Utah. First, data were collected from the iPeMS database, the Utah Vehicle Collisions database, and other sources for preparation. Then the USLIMITS2 web-based tool was operated with the obtained data for each small city or town. Detailed analysis information is presented as follows.

4.2 Garden City Town

As shown in **Figure 4**, state highway SR-30 crosses Garden City Town and there is a speed-limit change at the entrance of the town along SR-30 northbound.

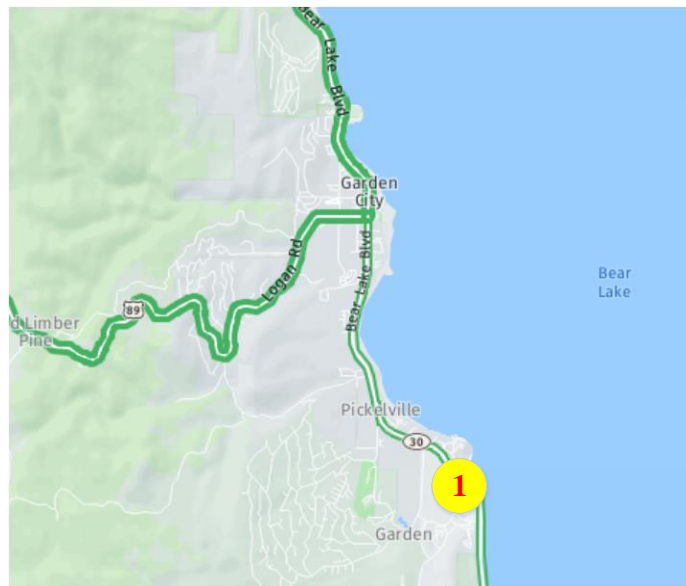


Figure 4 Selected location in Garden City Town

Location 1

At location 1, the speed limit changes from 55 mph to 40 mph. The data for USLIMITS2 are shown in **Table 3**.

Table 3 Data of location 1 in Garden City Town

AADT	1263
85th percentile speed	45 mph
50th percentile speed	44 mph
Speed limit	40 mph
Study Segment	MP113.5 – MP113
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	3
# of the signalized intersections	0

After running the USLIMITS2 for the selected location, the recommended speed limit is 45 mph, which is 5 mph higher than the existing speed limit.

4.2 Randolph City

As shown in **Figure 5**, SR-16 passes through Randolph City and there are speed-limit changes at both the north and south entrances of the city.

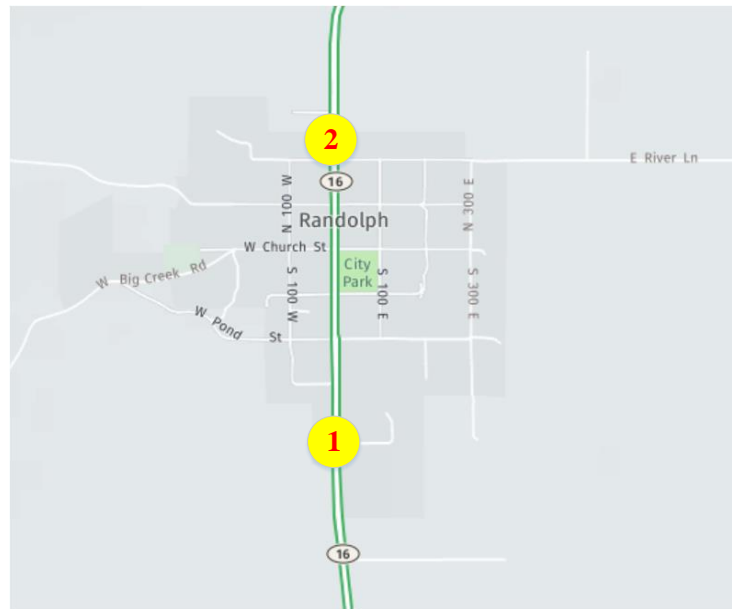


Figure 5 Selected locations in Randolph City

Location 1

At location 1, the speed limit changes from 65 mph to 55 mph. The data for location 1 for USLIMITS2 are shown in **Table 4**.

Table 4 Data of location 1 in Randolph City

AADT	855
85th percentile speed	55 mph
50th percentile speed	50 mph
Speed limit	55 mph
Study Segment	MP20 – MP20.5
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	4
# of signalized intersections	0

Location 2

For location 2, the speed limit changes from 55mph to 40mph. The data of location 2 for USLIMITS2 are shown in **Table 5**.

Table 5 Data of location 2 in Randolph City

AADT	1275
85th percentile speed	60 mph
50th percentile speed	56 mph
Speed limit	40 mph
Study Segment	MP21.5 – MP20.5
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	4
# of signalized intersections	0

After running USLIMITS2 for both locations in Randolph City, the results are shown in **Table 6**. For location 1, the recommended speed limit is 55 mph which is the same as the existing speed limit. For location 2, the recommended speed limit is 55 mph. That is 15 mph higher than the existing speed limit.

Table 6 Recommended speed limit for two locations in Randolph City

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	55	55
Location 2	40	55

4.3 Woodruff Town

SR-39 and SR-16 pass through Woodruff Town and there are speed-limit changes at both the north and west entrances of the town, as shown in **Figure 6**.

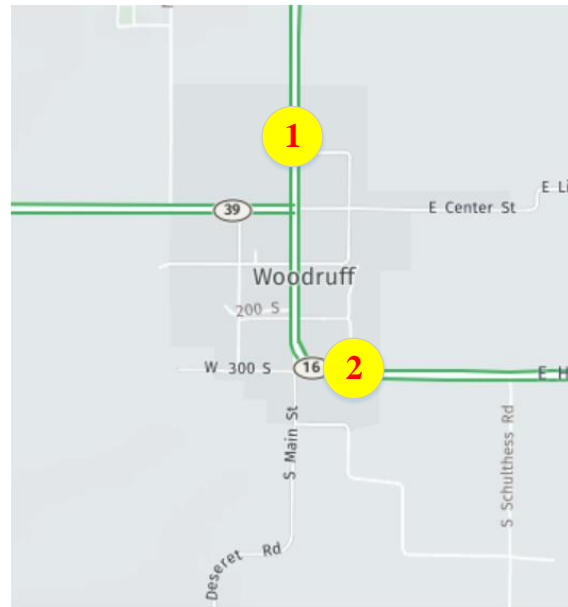


Figure 6 Selected locations in Woodruff Town

Location 1

At location 1, the speed limit changes from 65 mph to 40 mph. The data of location 1 for USLIMITS2 are shown in **Table 7**.

Table 7 Data of location 1 in Woodruff Town

AADT	795
85th percentile speed	61 mph
50th percentile speed	60 mph
Speed limit	40 mph
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	2
# of signalized intersections	0

Notably, the 85th percentile speed is 61 mph. Hence, the USLIMITS2 cannot be implemented because it is higher than 60 mph.

Location 2

At location 2, the speed limit changes from 65 mph to 40 mph. The data of location 2 for USLIMITS2 are shown in **Table 8**.

Table 8 Data of location 2 in Woodruff Town

AADT	735
85th percentile speed	56 mph
50th percentile speed	49 mph
Speed limit	40 mph
Study Segment	MP9.5 – MP10
Crash / Injury & Fatal (2017)	2 / 0
# of unsignalized intersections	1
# of signalized intersections	0

After running USLIMITS2 for location 2 in Woodruff Town, the recommended speed limit is 50 mph. That is 10 mph higher than the existing speed limit.

4.4 Grantsville City

SR-138 and SR-112 pass through Grantsville City and there is a speed-limit change at the south entrance of the city, as shown in **Figure 7**.

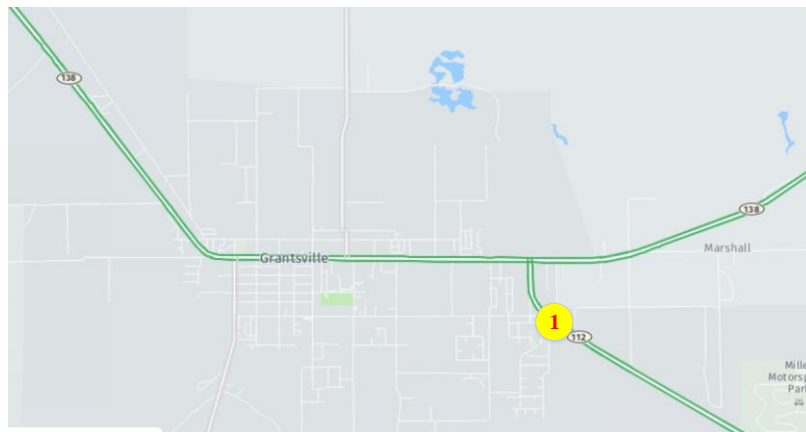


Figure 7 Selected location in Grantsville City

Location 1

At location 1, the speed limit changes from 50 mph to 40 mph. The data of location 1 for USLIMITS2 are shown in **Table 9**.

Table 9 Data of location 1 in Grantsville City

AADT	3444
85th percentile speed	53 mph
50th percentile speed	52 mph
Speed limit	40 mph
Study segment	MP0 – MP0.8
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	2
# of signalized intersections	0

After running USLIMITS2 for location 1 in Grantsville City, the recommended speed limit is 50 mph. That is 10 mph higher than the existing speed limit.

4.5 Tooele City

SR-36 and SR-112 pass through Tooele City and there are speed-limit changes at the north, south, and west entrances of the city, as shown in **Figure 8**.

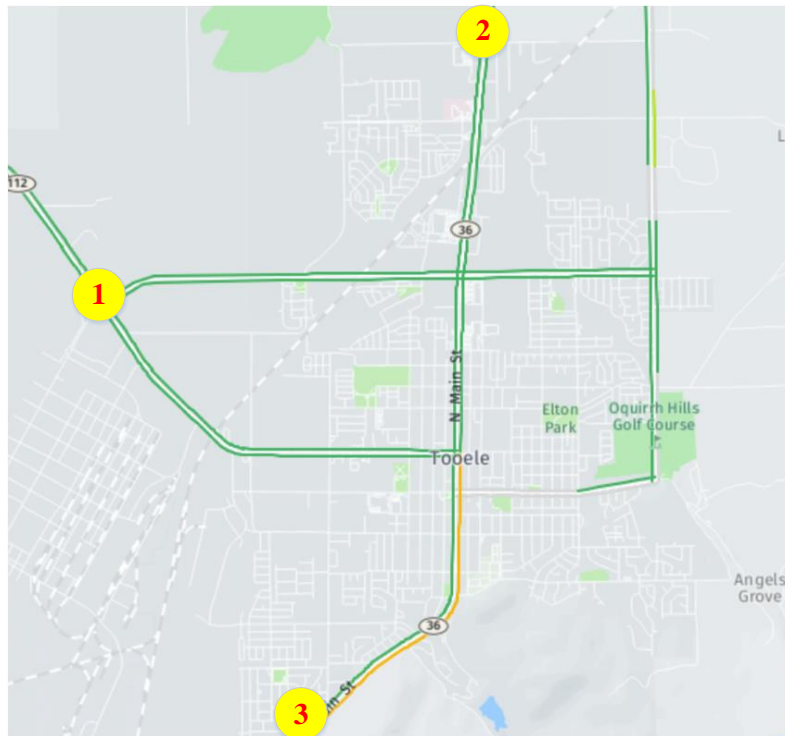


Figure 8 Selected locations in Tooele City

Location 1

For location 1, the speed limit changes from 60 mph to 50 mph. The data of location 1 for USLIMITS2 are shown in **Table 10**.

Table 10 Data of location 1 in Tooele City

AADT	3948
85th percentile speed	59 mph
50th percentile speed	55 mph
Speed limit	60 mph
Study segment	MP5 – MP6
Crash / Injury & Fatal (2017)	6 / 3
# of unsignalized intersections	0
# of signalized intersections	1

Location 2

For location 2, the speed limit changes from 60 mph to 50 mph. The data of location 2 for USLIMITS2 are shown in **Table 11**.

Table 11 Data of location 2 in Tooele City

AADT	13314
85th percentile speed	44 mph
50th percentile speed	41 mph
Speed limit	50 mph
Study segment	MP58 – MP57
Crash / Injury & Fatal (2017)	21/ 10
# of unsignalized intersections	1
# of signalized intersections	2

Location 3

For location 3, the speed limit changes from 60 mph to 55 mph. The data of location 3 for USLIMITS2 are shown in **Table 12**.

Table 12 Data of location 3 in Tooele City

AADT	3897
85th percentile speed	53 mph
50th percentile speed	51 mph
Speed limit	55 mph
Study segment	MP52 – MP53
Crash / Injury & Fatal (2017)	12 / 2
# of unsignalized intersections	5
# of signalized intersections	0

After running USLIMITS 2 for the three locations in Tooele City, the results are shown in **Table 13**. For location 1, the recommended speed limit is 55 mph. That is the same as the existing speed limit. For location 2, the recommended speed limit is 40 mph. That is 10 mph lower than the existing speed limit. For location 3, the recommended speed limit is 50 mph. That is 5 mph lower than the existing speed limit.

Table 13 Recommended speed limit for three locations in Tooele City

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	55	55
Location 2	50	40
Location 3	55	50

4.6 Park City

SR-224 and SR-248 pass through Park City and there is a speed-limit change at the east entrance of Park City, as shown in **Figure 9**.

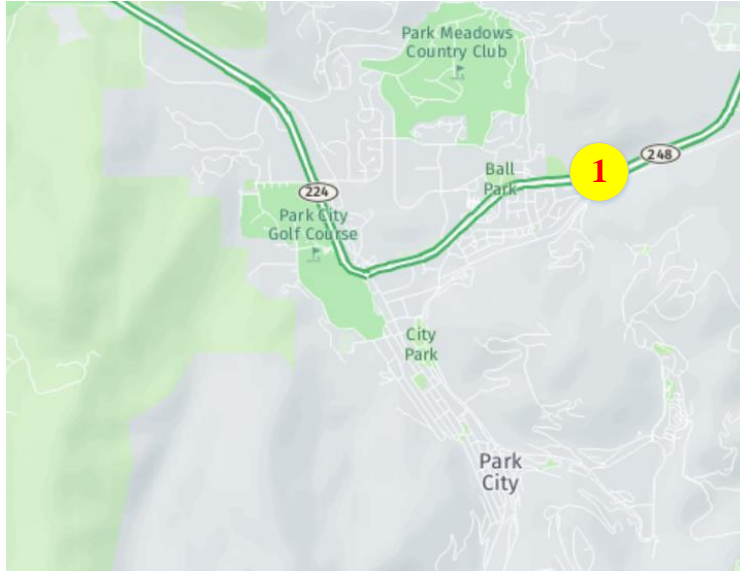


Figure 9 Selected location in Park City

Location 1

At location 1, the speed limit changes from 50 mph to 35 mph. The data of location 1 for USLIMITS 2 are shown in **Table 14**.

Table 14 Data of location 1 in Park City

AADT	10818
85th percentile speed	39 mph
50th percentile speed	33 mph
Speed limit	35 mph
Study segment	MP1.5 – MP1
Crash / Injury & Fatal (2017)	11 / 2
# of unsignalized intersections	3
# of signalized intersections	1

After running USLIMITS2 for location 1 in Park City, the recommended speed limit is 35 mph. That is the same as the existing speed limit.

4.7 Stockton Town

SR-36 passes through Stockton Town and there are speed-limit changes at both north and south entrances of Stockton town, as shown in **Figure 10**.

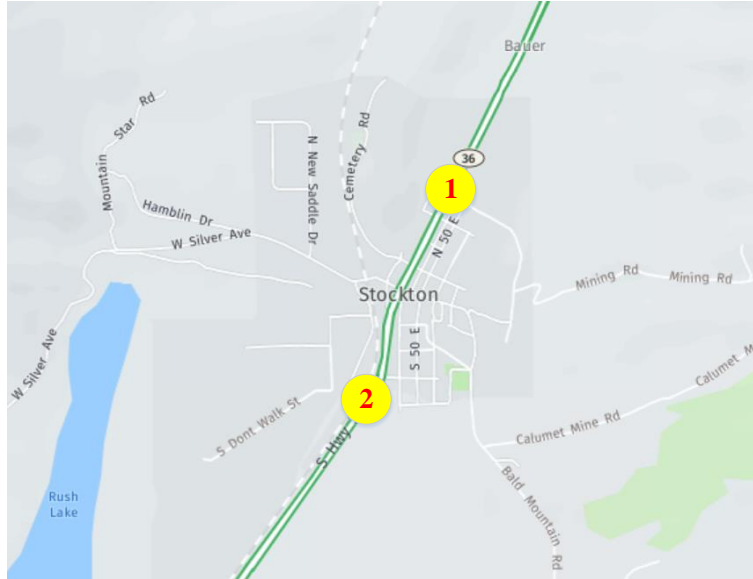


Figure 10 Selected locations in Stockton Town

Location 1

For location 1, the speed limit changes from 60 mph to 40 mph. The data of location 1 for USLIMITS2 are shown in **Table 15**.

Table 15 Data of location 1 in Stockton Town

AADT	3891
85th percentile speed	52 mph
50th percentile speed	51 mph
Speed limit	40 mph
Study segment	MP47 – MP47.6
Crash / Injury & Fatal (2017)	2 / 1
# of unsignalized intersections	2
# of signalized intersections	0

Location 2

For location 2, the speed limit changes from 65 mph to 40 mph. The data of location 2 for USLIMITS2 are shown in **Table 16**.

Table 16 Data of location 2 in Stockton Town

AADT	3897
85th percentile speed	53 mph
50th percentile speed	51 mph
Speed limit	40 mph
Study segment	MP48.5 – MP48
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	1
# of signalized intersections	0

After running USLIMITS2 at both locations of Stockton Town, the results are shown in **Table 17**. For location 1, the recommended speed limit is 50 mph. That is 10 mph higher than the existing speed limit. For location 2, the recommended speed limit is 50 mph. That is 10 mph higher than the existing speed limit.

Table 17 Recommended speed limit for two locations in Stockton Town

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	40	50
Location 2	40	50

4.8 Cedar Fort Town

SR-73 passes through Cedar Fort Town. There is a speed-limit change at the entrance of SR-73 as shown in **Figure 11**.

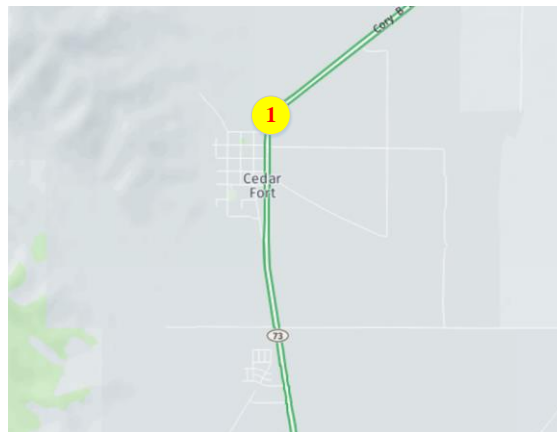


Figure 11 Selected location in Cedar Fort Town

Location 1

At location 1, the speed limit changes from 65 mph to 50 mph. The data of location 1 for USLIMITS2 are shown in **Table 18**.

Table 18 Data of location 1 in Stockton Town

AADT	1110
85th percentile speed	63 mph
50th percentile speed	62 mph
Speed limit	50 mph
Crash / Injury & Fatal (2017)	3 / 1
# of unsignalized intersections	2
# of signalized intersections	0

Notably, the 85th percentile speed is 61 mph which is higher than 60 mph. Hence, the USLIMITS2 cannot be adopted here.

4.9 Santaquin City

US-6 and SR-198 pass through Santaquin City, and there are speed-limit changes at both north and west entrances of the city, as shown in **Figure 12**.

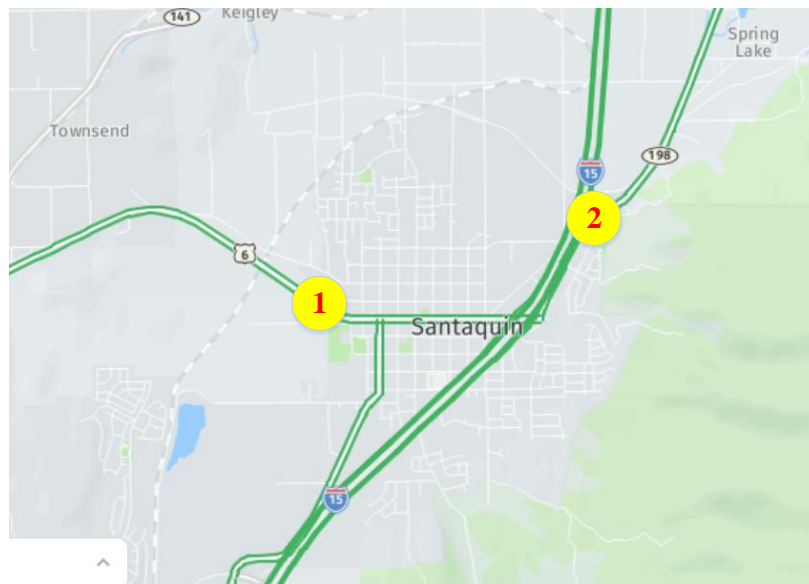


Figure 12 Selected locations in Santaquin City

Location 1

At location 1, the speed limit changes from 60 mph to 35 mph. The data of location 1 for USLIMITS2 are shown in **Table 19**.

Table 19 Data of location 1 in Santaquin City

AADT	2583
85th percentile speed	52 mph
50th percentile speed	49 mph
Speed limit	35 mph
Study segment	MP159 – MP159.5
Crash / Injury & Fatal (2017)	2 / 1
# of unsignalized intersections	4
# of signalized intersections	0

Location 2

At location 2, the speed limit changes from 55 mph to 45 mph. The data of location 2 for USLIMITS2 are shown in **Table 20**.

Table 20 Data of location 2 in Santaquin City

AADT	3417
85th percentile speed	47 mph
50th percentile speed	42 mph
Speed limit	45 mph
Study segment	MP1 – MP0
Crash / Injury & Fatal (2017)	10 / 1
# of unsignalized intersections	2
# of signalized intersections	1

After running USLIMITS2, the results are shown in **Table 21**. For location 1, the recommended speed limit is 50 mph. That is 15 mph higher than the existing speed limit. For location 2, the recommended speed limit is 40 mph. That is 5 mph lower than the existing one.

Table 21 Recommended speed limit for two locations in Santaquin City

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	35	50
Location 2	45	40

4.10 Eureka City

US-6 passes through Eureka City and there are speed-limit changes at both north and south entrances of the city, as shown in **Figure 13**.



Figure 13 Selected locations in Eureka City

Location 1

At location 1, the speed limit changes from 65 mph to 30 mph. The data of location 1 for USLIMITS2 are shown in **Table 22**.

Table 22 Data of location 1 in Eureka City

AADT	687
85th percentile speed	42 mph
50th percentile speed	39 mph
Speed limit	30 mph
Study segment	MP139.5 – MP140
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	5
# of signalized intersections	0

Location 2

For location 2, the speed limit changes from 60 mph to 30 mph. The data of location 2 for USLIMITS2 are shown in **Table 23**.

Table 23 Data of location 2 in Eureka City

AADT	684
85th percentile speed	41 mph
50th percentile speed	38 mph
Speed limit	30 mph
Study segment	MP141 – MP140.5
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	5
# of signalized intersections	0

After running USLIMITS2 at both locations of Eureka City, the results are shown in **Table 24**. For location 1, the recommended speed limit is 40 mph. That is 10 mph higher than the existing speed limit. For location 2, the recommended speed limit is 40 mph. That is 10 mph higher than the existing speed limit.

Table 24 Recommended speed limit for two locations in Eureka City

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	30	40
Location 2	30	40

4.11 Kamas City

SR-32, SR-248 and SR-150 pass through Kamas City, but there is only one speed-limit change at the north entrance of the city, as shown in **Figure 14**.

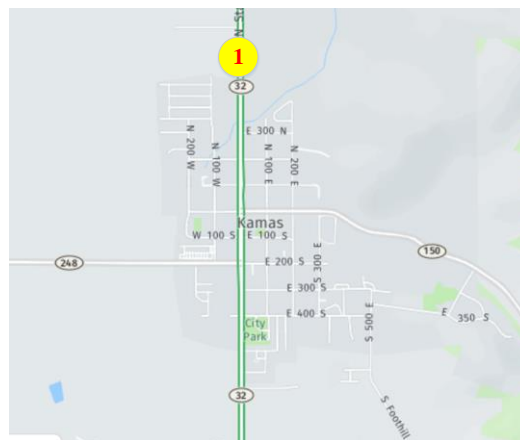


Figure 14 Selected location in Kamas City

Location 1

At location 1, the speed limit changes from 55 mph to 35 mph. The data of location 1 for USLIMITS2 are shown in **Table 25**.

Table 25 Data of location 1 in Kamas City

AADT	2160
85th percentile speed	43 mph
50th percentile speed	40 mph
Speed limit	35 mph
Study segment	MP13.3 – MP12.8
Crash / Injury & Fatal (2017)	2 / 1
# of unsignalized intersections	3
# of signalized intersections	0

After running USLIMITS2 at location 1 of Kamas City, the recommended speed limit is 40 mph. That is 5 mph higher than the existing speed limit.

4.12 Heber City

US-40 passes through Heber City, and there is a speed-limit change at the north entrance of the city, as shown in **Figure 15**.

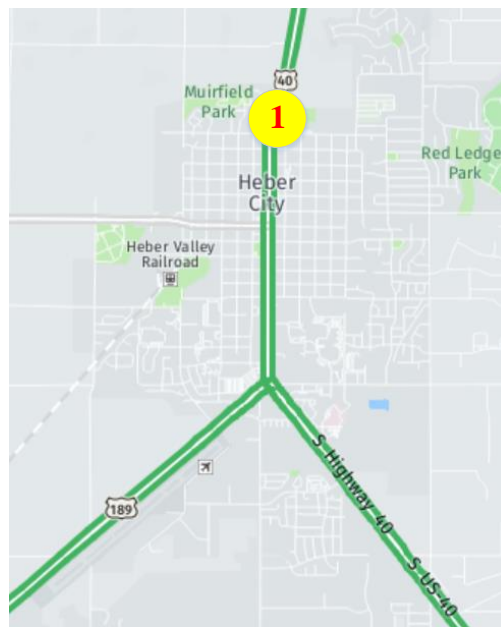


Figure 15 Selected location in Heber City

Location 1

At location 1, the speed limit changes from 55 mph to 35 mph. The data of location 1 for USLIMITS2 are shown in Table 6.

Table 26 Data of location 1 in Heber City

AADT	12513
85th percentile speed	48 mph
50th percentile speed	46 mph
Speed limit	35 mph
Study segment	MP16.2 – MP16.7
Crash / Injury & Fatal (2017)	15 / 3
# of unsignalized intersections	3
# of signalized intersections	1

After running USLIMITS2 for location 1 in Heber City, the recommended speed limit is 45 mph. That is 10 mph higher than the existing speed limit.

4.13 Duchesne City

US-40 passes through Duchesne City, and there are speed-limit changes at both east and west entrances of the city, as shown in **Figure 16**.



Figure 16 Selected locations in Duchesne City

Location 1

At location 1, the speed limit changes from 65 mph to 40 mph. The data of location 1 for USLIMITS2 are shown in **Table 27**.

Table 27 Data of location 1 in Duchesne City

AADT	3282
85th percentile speed	61 mph
50th percentile speed	60 mph
Speed limit	40 mph
Crash / Injury & Fatal (2017)	2 / 0
# of unsignalized intersections	3
# of signalized intersections	0

The 85th percentile speed is 61 mph which is higher than 60 mph. Hence, the USLIMITS2 cannot be implemented here.

Location 2

At location 2, the speed limit changes from 45 mph to 40 mph. The data of location 2 for USLIMITS2 are shown in **Table 28**.

Table 28 Data of location 2 in Duchesne City

AADT	3279
85th percentile speed	61 mph
50th percentile speed	60 mph
Speed limit	40 mph
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	4
# of signalized intersections	0

The 85th percentile speed is 61 mph which is higher than 60 mph. Hence, the USLIMITS2 cannot be implemented here.

4.14 Roosevelt City

US-40 passes through Roosevelt City, and there is a speed-limit change at the east entrance of the city, as shown in **Figure 17**.

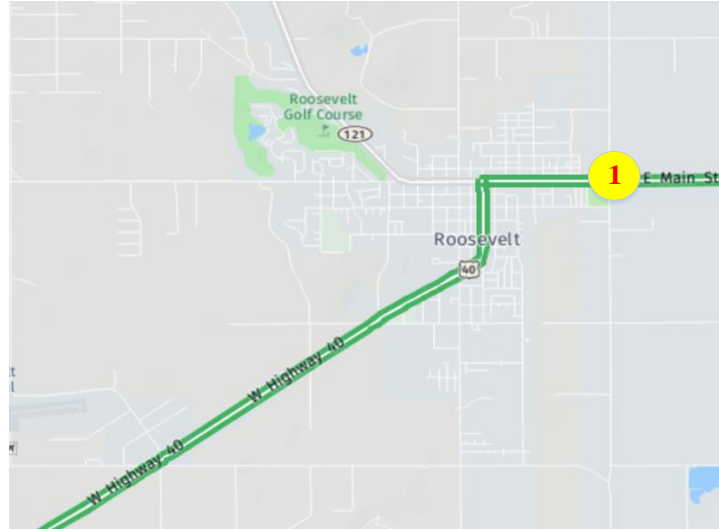


Figure 17 Selected location in Roosevelt City

Location 1

At location 1, the speed limit changes from 50 mph to 35 mph. The data of location 1 for USLIMITS2 are shown in **Table 29**.

Table 29 Data of location 1 in Roosevelt City

AADT	5793
85th percentile speed	48 mph
50th percentile speed	46 mph
Speed limit	35 mph
Study segment	MP116 – MP115
Crash / Injury & Fatal (2017)	9 / 2
# of unsignalized intersections	3
# of signalized intersections	1

After running USLIMITS2 for location 1 in Roosevelt City, the recommended speed limit is 45 mph. That is 10 mph higher than the existing speed limit.

4.15 Vernal City

SR-121, US-40, and US-191 pass through Vernal City, and there is a speed-limit change at the west entrance of the city, as shown in **Figure 18**.

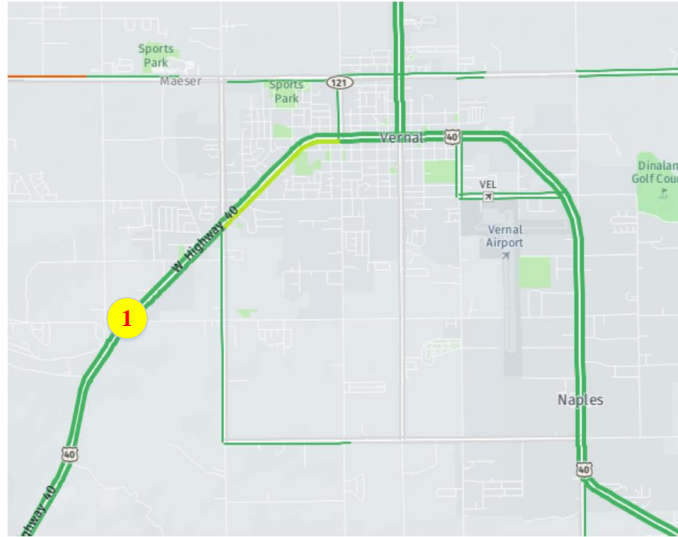


Figure 18 Selected location in Vernal City

Location 1

At location 1, the speed limit changes from 65 mph to 40 mph. The data of location 1 for USLIMITS2 are shown in **Table 30**.

Table 30 Data of location 1 in Vernal City

AADT	3282
85th percentile speed	61 mph
50th percentile speed	60 mph
Speed limit	40 mph
Crash / Injury & Fatal (2017)	2 / 0
# of unsignalized intersections	3
# of signalized intersections	0

The 85th percentile speed is 61 mph which is higher than 60 mph. Hence, the USLIMITS2 cannot be implemented here.

4.16 Delta City

US-50 and US-6 pass through Delta City, and there are speed-limit changes at the east entrances of the city, as shown in **Figure 19**.

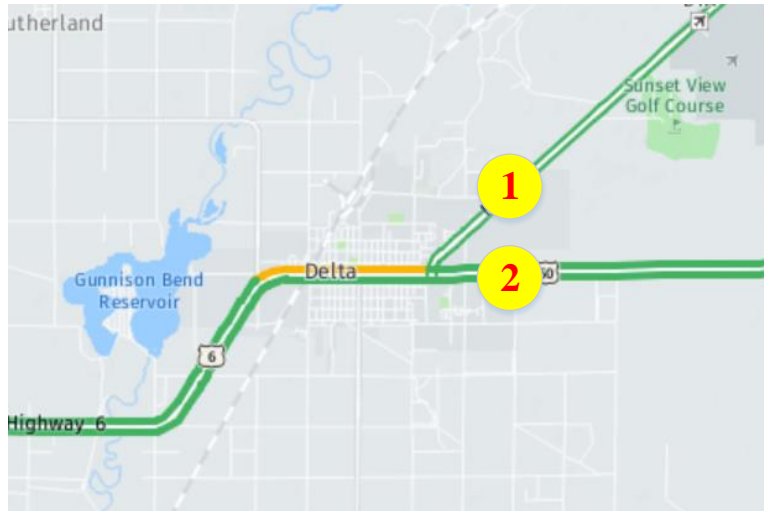


Figure 19 Selected locations in Delta City

Location 1

At location 1, the speed limit changes from 65 mph to 45 mph. The data of location 1 for USLIMITS2 are shown in **Table 31**.

Table 31 Data of location 1 in Delta City

AADT	1686
85th percentile speed	54 mph
50th percentile speed	51 mph
Speed limit	45 mph
Study segment	MP91– MP90
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	3
# of signalized intersections	0

Location 2

At location 2, the speed limit changes from 65 mph to 55 mph. The data of location 2 for USLIMITS2 are shown in **Table 32**.

Table 32 Data of location 2 in Delta City

AADT	1263
85th percentile speed	55 mph
50th percentile speed	50 mph
Speed limit	55 mph

Study segment	MP90.5 – MP90
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	1
# of signalized intersections	0

After running USLIMITS2 at both locations in Eureka City, the results are shown in **Table 33**. For location 1, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit. For location 2, the recommended speed limit is 55 mph. That is the same as the existing speed limit.

Table 33 Recommended speed limit for two locations in Delta City

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	45	55
Location 2	55	55

4.17 Nephi City

SR-132 and SR-28 pass through Nephi City, and there are speed-limit changes at the north, east, and west entrances of the city, as shown in **Figure 20**.

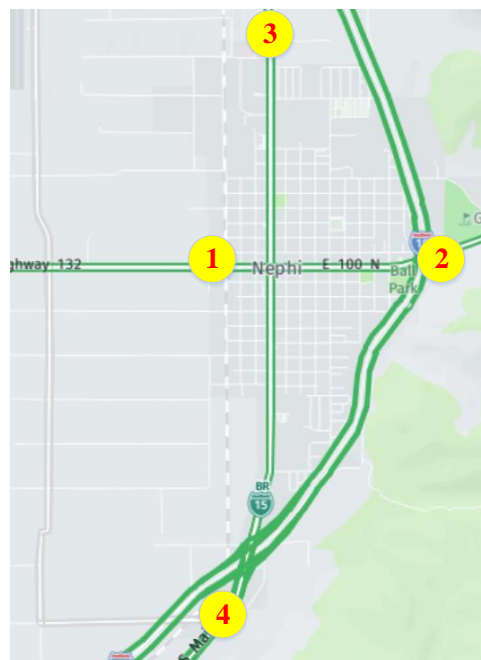


Figure 20 Selected locations in Nephi City

Location 1

Location 1 is the city entrance via eastbound SR-132, and the speed limit changes from 65 mph to 35 mph. The data of location 1 for USLIMITS2 are shown in **Table 34**.

Table 34 Data of location 1 in Nephi City

AADT	1521
85th percentile speed	40 mph
50th percentile speed	38 mph
Speed limit	35 mph
Study segment	MP32.5– MP33
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	3
# of signalized intersections	0

Location 2

Location 2 is the city entrance via westbound SR-132, and the speed limit changes from 55 mph to 45 mph. The data of location 2 for USLIMITS2 are shown in **Table 35**.

Table 35 Data of location 2 in Nephi City

AADT	1890
85th percentile speed	53 mph
50th percentile speed	51 mph
Speed limit	45 mph
Study segment	MP35 – MP34.5
Crash / Injury & Fatal (2017)	7 / 1
# of unsignalized intersections	4
# of signalized intersections	0

Location 3

Location 3 is the city entrance via northbound SR-28, and the speed limit changes from 55 mph to 45 mph. The data of location 3 for USLIMITS2 are shown in **Table 36**.

Table 36 Data of location 3 in Nephi City

AADT	4497
85th percentile speed	41 mph
50th percentile speed	38 mph
Speed limit	45 mph

Study segment	MP42.5– MP42
Crash / Injury & Fatal (2017)	2 / 0
# of unsignalized intersections	3
# of signalized intersections	0

Location 4

Location 4 is the city entrance via northbound SR-28, and the speed limit changes from 65 mph to 45 mph. The data of location 1 for USLIMITS2 are shown in **Table 37**.

Table 37 Data of location 4 in Nephi City

AADT	1152
85th percentile speed	59 mph
50th percentile speed	57 mph
Speed limit	45 mph
Study segment	MP38 – MP38.5
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	2
# of signalized intersections	0

After running USLIMITS2 at the four locations in Nephi City, the results are shown in **Table 38**. For location 1, the recommended speed limit is 40 mph. That is 5 mph higher than the existing speed limit. For location 2, the recommended speed limit is 50 mph. That is 5 mph higher than the existing speed limit. For location 3, the recommended speed limit is 40 mph. That is 5 mph lower than the existing speed limit. For location 4, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit.

Table 38 Recommended speed limit for 2 locations in Nephi City

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	35	40
Location 2	45	50
Location 3	45	40
Location 4	45	55

4.18 Levan Town

SR-78 and SR-28 pass through Levan Town, and there are speed-limit changes on both SR-78 and SR-28, as shown in **Figure 21**.



Figure 21 Selected locations in Levan Town

Location 1

Location 1 is on SR-78, and the speed limit changes from 60 mph to 35 mph. The data of location 1 for USLIMITS2 are shown in **Table 39**.

Table 39 Data of location 1 in Levan Town

AADT	426
85th percentile speed	57mph
50th percentile speed	54mph
Speed limit	35 mph
Study segment	MP9– MP9.5
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	3
# of signalized intersections	0

Location 2

Location 2 is on the southbound entrance of SR-28, and the speed limit changes from 65 mph to 35 mph. The data of location 2 for USLIMITS2 are shown in **Table 40**.

Table 40 Data of location 2 in Levan Town

AADT	1389
85th percentile speed	49 mph
50th percentile speed	47 mph
Speed limit	35 mph
Study segment	MP29 – MP29.5
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	2
# of signalized intersections	0

Location 3

Location 3 is on the northbound entrance of SR-28, and the speed limit changes from 65 mph to 35 mph. The data of location 3 for USLIMITS2 are shown in **Table 41**.

Table 41 Data of location 3 in Levan Town

AADT	1131
85th percentile speed	60 mph
50th percentile speed	57 mph
Speed limit	35 mph
Study segment	MP30.5– MP30
Crash / Injury & Fatal (2017)	2 / 1
# of unsignalized intersections	4
# of signalized intersections	0

After running USLIMITS2 at the three locations in Levan Town, the results are shown in **Table 42**. For location 1, the recommended speed limit is 55 mph. That is 20 mph higher than the existing speed limit. For location 2, the recommended speed limit is 45 mph. That is 10 mph higher than the existing speed limit. For location 3, the recommended speed limit is 55 mph. That is 20 mph higher than the existing speed limit.

Table 42 Recommended speed limit for three locations in Levan Town

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	35	55
Location 2	35	45
Location 3	35	55

4.19 Scipio Town

US-50 passes through Scipio Town, and there is a speed-limit change at the north entrance of the town, as shown in **Figure 22**.

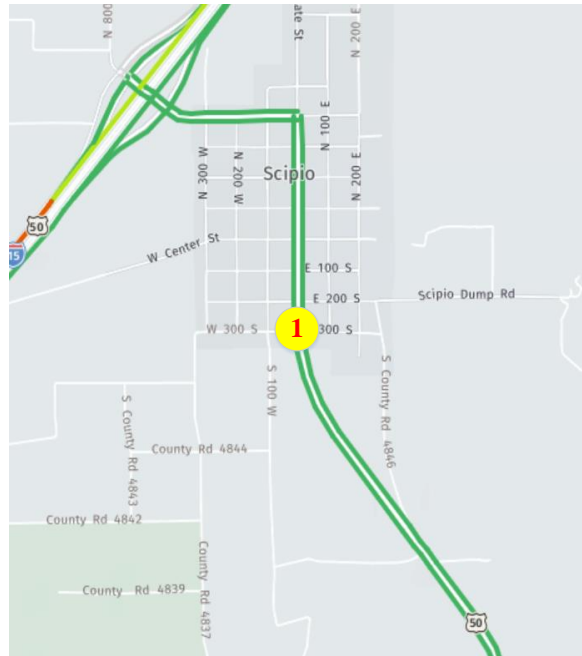


Figure 22 Selected location in Scipio Town

Location 1

Location 1 is at the northbound entrance of US-50, and the speed limit changes from 65 mph to 35 mph. The data of location 1 for USLIMITS2 are shown in **Table 43**.

Table 43 Data of location 1 in Scipio Town

AADT	1989
85th percentile speed	60 mph
50th percentile speed	59 mph
Speed limit	35 mph
Study segment	MP131.5 – MP131
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	3
# of signalized intersections	0

After running USLIMITS2 for location 1 in Scipio Town, the recommended speed limit is 55 mph. That is 20 mph more than the existing speed limit.

4.20 Beaver City

SR-21 passes through Beaver City, and there is a speed-limit change at the entrance of SR-21 to the city, as shown in **Figure 23**.

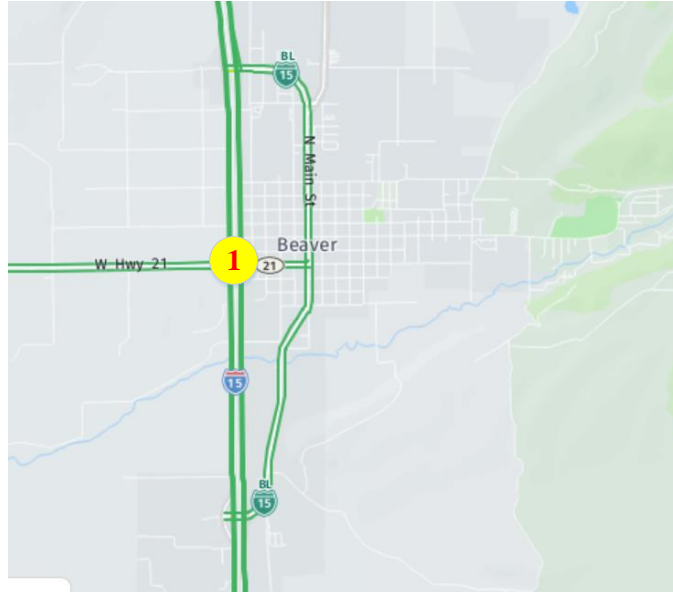


Figure 23 Selected location in Beaver City

Location 1

Location 1 is on SR-21, and the speed limit changes from 55 mph to 35 mph. The data of location 1 for USLIMITS2 are shown in **Table 44**.

Table 44 Data of location 1 in Beaver City

AADT	885
85th percentile speed	53 mph
50th percentile speed	50 mph
Speed limit	35 mph
Study segment	MP106.5 – MP107.2
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	3
# of signalized intersections	0

After running USLIMITS2 for location 1 in Beaver City, the recommended speed limit is 50 mph. That is 15 mph higher than the existing speed limit.

4.21 Milford City

SR-21, SR-129, and SR-153 pass through Milford City, and there are speed-limit changes at the entrances of southbound SR-257 and eastbound SR-21, as shown in **Figure 24**.



Figure 24 Selected locations in Milford City

Location 1

Location 1 is on SR-21, and the speed limit changes from 55 mph to 30 mph. The data of location 1 for USLIMITS2 are shown in **Table 45**.

Table 45 Data of location 1 in Milford City

AADT	186
85th percentile speed	62 mph
50th percentile speed	58 mph
Speed limit	30 mph
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	3
# of signalized intersections	0

The 85th percentile speed is 61 mph which is higher than 60 mph. Hence, the USLIMITS2 cannot be adopted here for analysis.

Location 2

Location 2 is on southbound SR-257, and the speed limit changes from 65 mph to 45 mph. The data of location 2 for USLIMITS2 are shown in **Table 46**.

Table 46 Data of location 2 in Milford City

AADT	534
85th percentile speed	49 mph
50th percentile speed	46 mph
Speed limit	45 mph
Study segment	MP1 – MP0.5
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	3
# of signalized intersections	0

After running USLIMITS2 for location 2 in Milford City, the recommended speed limit is 50 mph. That is 5 mph higher than the existing speed limit.

4.22 Cedar City

SR-14 and SR-56 pass through Cedar City, and there are speed-limit changes on both SR-14 and SR-56, as shown in **Figure 25**.

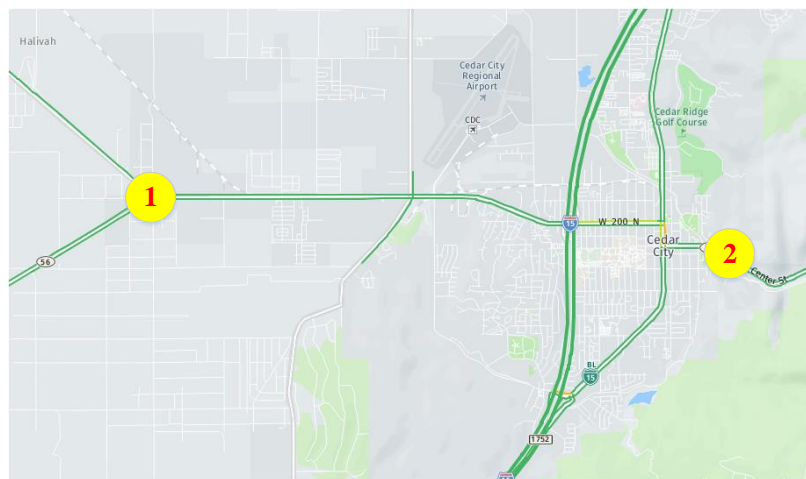


Figure 25 Selected locations in Cedar City

Location 1

Location 1 is on SR-56, and the speed limit changes from 65 mph to 55 mph. The data of location 1 for USLIMITS2 are shown in **Table 47**.

Table 47 Data of location 1 in Cedar City

AADT	807
85th percentile speed	63 mph
50th percentile speed	62 mph
Speed limit	55 mph
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	3
# of signalized intersections	0

The 85th percentile speed is 61 mph which is higher than 60 mph. Hence, the USLIMITS2 cannot be adopted for analysis here.

Location 2

Location 2 is on SR-14, and the speed limit changes from 50 mph to 30 mph. The data of location 2 for USLIMITS2 are shown in Table 6.

Table 48 Data of location 2 in Cedar City

AADT	1377
85th percentile speed	44 mph
50th percentile speed	42 mph
Speed Limit	30 mph
Study segment	MP0 – MP1
Crash (2017)	18 / 5
# of unsignalized intersections	8
# of signalized intersections	0

After running USLIMITS2 for location 2 in Cedar City, the recommended speed limit is 40 mph. That is 10 mph higher than the existing speed limit.

4.23 Hildale City

SR-59 passes through Hildale City, and there is a speed-limit change on SR-59, as shown in **Figure 26**.

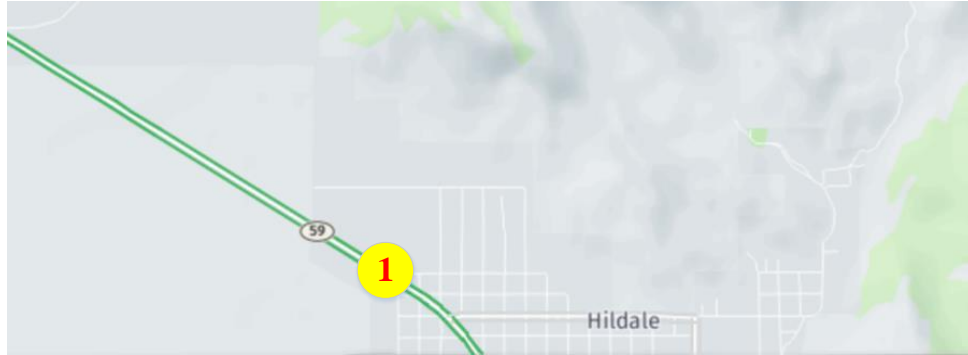


Figure 26 Selected location in Hildale City

Location 1

Location 1 is at the entrance via SR-59, and the speed limit changes from 65 mph to 40 mph. The data of location 1 for USLIMITS2 are shown in **Table 49**.

Table 49 Data of location 1 in Hildale City

AADT	2223
85th percentile speed	64 mph
50th percentile speed	63 mph
Speed Limit	40 mph
Crash (2017)	0 / 0
# of unsignalized intersections	3
# of signalized intersections	0

The 85th percentile speed is 61 mph which is higher than 60 mph, and the USLIMITS2 cannot be adopted for analysis.

4.24 Fairview City

SR-31 and US-89 pass through Fairview City, and there is a speed-limit change at the city entrance via northbound US-89, as shown in **Figure 27**.

Table 52 Data of location 2 in Moroni City

AADT	1437
85th percentile speed	47 mph
50th percentile speed	41 mph
Speed limit	30 mph
Study segment	MP57.7 – MP56.2
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	2
# of signalized intersections	0

Location 3

Location 3 is on SR-116, and the speed limit changes from 55 mph to 40 mph. The data of location 3 for USLIMITS2 are shown in **Table 53**.

Table 53 Data of location 3 in Moroni City

AADT	1398
85th percentile speed	51 mph
50th percentile speed	47 mph
Speed limit	40 mph
Study segment	MP1 – MP0
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	2
# of signalized intersections	0

After running USLIMITS2 for the three locations in Moroni City, the results are shown in **Table 54**. For location 1, the recommended speed limit is 55 mph. That is 15 mph higher than the existing speed limit. For location 2, the recommended speed limit is 45 mph. That is 15 mph higher than the existing speed limit. For location 3, the recommended speed limit is 50 mph. That is 10 mph higher than the existing speed limit.

Table 54 Recommended speed limit for 2 locations in Moroni City

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	40	55
Location 2	30	45
Location 3	40	50

4.26 Ephraim City

US-89 passes through Ephraim City, and there are speed-limit changes on both the north and south entrances of the city, as shown in **Figure 29**.

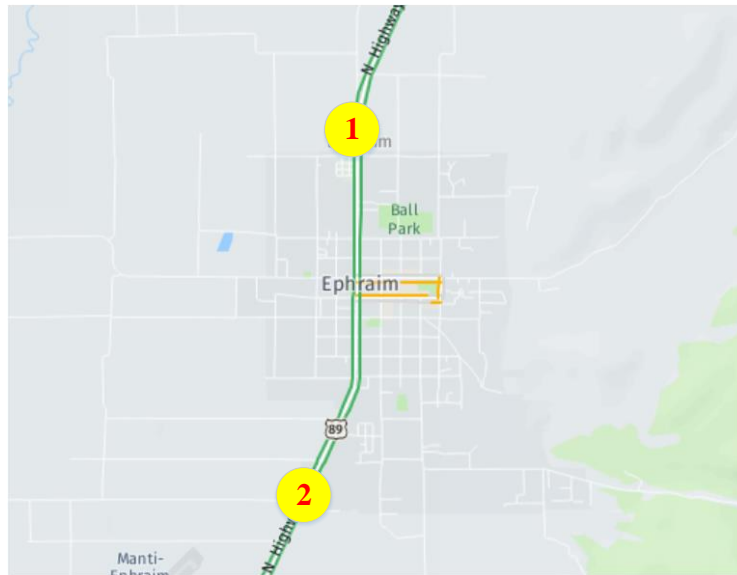


Figure 29 Selected locations in Ephraim City

Location 1

Location 1 is on southbound US-89, and the speed limit changes from 65 mph to 45 mph. The data of location 1 for USLIMITS2 are shown in **Table 55**.

Table 55 Data of location 1 in Ephraim City

AADT	3543
85th percentile speed	49 mph
50th percentile speed	46 mph
Speed limit	45 mph
Study segment	MP264 – MP263.4
Crash / Injury & Fatal (2017)	5 / 1
# of unsignalized intersections	3
# of signalized intersections	0

Location 2

Location 2 is on northbound US-89, and the speed limit changes from 65 mph to 45 mph. The data of location 2 for USLIMITS2 are shown in **Table 56**.

Table 56 Data of location 2 in Ephraim City

AADT	3681
85th percentile speed	50 mph
50th percentile speed	47 mph
Speed limit	45 mph
Study segment	MP261 – MP261.5
Crash / Injury & Fatal (2017)	6 / 1
# of unsignalized intersections	4
# of signalized intersections	0

After running USLIMITS2 for both locations in Ephraim City, the results are shown in **Table 57**. For location 1, the recommended speed limit is 45 mph. That is the same as the existing speed limit. For location 2, the recommended speed limit is 45 mph. That is the same as the existing speed limit.

Table 57 Recommended speed limit for 2 locations in Ephraim City

Location	Existing Speed Limit	Recommended Speed Limit
Location 1	45 mph	45 mph
Location 2	45 mph	45 mph

4.27 Manti City

US-89 passes through Manti City, and there are speed-limit changes on both the north and south entrances of the city, as shown in **Figure 30**.

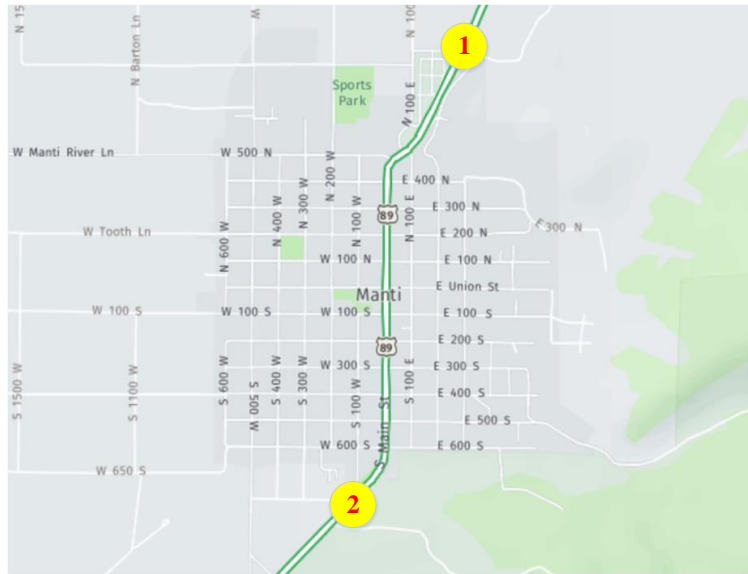


Figure 30 Selected locations in Manti City

Location 1

Location 1 is on southbound US-89, and the speed limit changes from 55 mph to 45 mph. The data of location 1 for USLIMITS2 are shown in **Table 58**.

Table 58 Data of location 1 in Manti City

AADT	2031
85th percentile speed	59 mph
50th percentile speed	57 mph
Speed limit	45 mph
Study segment	MP254 – MP255
Crash / Injury & Fatal (2017)	3 / 0
# of unsignalized intersections	4
# of signalized intersections	0

Location 2

Location 2 is on northbound US-89, and the speed limit changes from 65 mph to 45 mph. The data of location 2 for USLIMITS2 are shown in **Table 59**.

Table 59 Data of location 2 in Manti City

AADT	3681
85th percentile speed	50 mph
50th percentile speed	47 mph
Speed limit	45 mph
Study segment	MP261 – MP261.5
Crash / Injury & Fatal (2017)	6 / 1
# of unsignalized intersections	4
# of signalized intersections	0

After running USLIMITS2 for both locations in Manti City, the results are shown in **Table 60**. For location 1, the recommended speed limit is 50 mph. That is the same as the existing speed limit. For location 2, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit.

Table 60 Recommended speed limit for 2 locations in Manti City

Location	Existing Speed Limit (mph)	Recommended Speed Limit
Location 1	50	50
Location 2	45	55

4.28 Gunnison City

US-89, SR-137, and SR-28 pass through Gunnison City, and there are speed-limit changes on both the north and east entrances of the city, as shown in **Figure 31**.



Figure 31 Selected locations in Gunnison City

Location 1

Location 1 is on westbound US-89, and the speed limit changes from 65 mph to 55 mph. The data of location 1 for USLIMITS2 are shown in **Table 61**.

Table 61 Data of location 1 in Gunnison City

AADT	2016
85th percentile speed	58 mph
50th percentile speed	54 mph
Speed limit	55 mph
Study segment	MP242.2 – MP241.7
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	4
# of signalized intersections	0

After running USLIMITS2 for location 1 in Gunnison City, the recommended speed limit is 55 mph. That is the same as the existing speed limit.

Location 2

Location 2 is on SR-28, and the speed limit changes from 45 mph to 30 mph. The data of location 2 for USLIMITS2 are shown in **Table 62**.

Table 62 Data of location 2 in Gunnison City

AADT	1557
85th percentile speed	63 mph
50th percentile speed	62 mph
Speed limit	30 mph
Crash / Injury & Fatal (2017)	1 / 1
# of unsignalized intersections	3
# of signalized intersections	0

The 85th percentile speed is 63 mph. That is higher than 60 mph, therefore, the USLIMITS2 cannot be adopted here.

4.29 Salina City

US-89, US-50, and SR-24 pass through Salina City, and there is a speed-limit change on US-50, as shown in **Figure 32**.

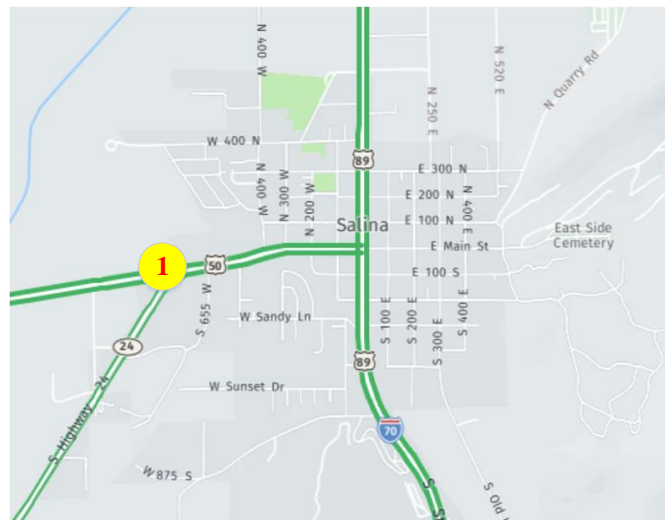


Figure 32 Selected location in Salina City

Location 1

The speed limit of location 1 changes from 65 mph to 40 mph. The data of location 1 for USLIMITS2 are shown in **Table 63**.

Table 63 Data of location 1 in Salina City

AADT	1980
85th percentile speed	56 mph
50th percentile speed	51 mph
Speed limit	40 mph
Study segment	MP157.5 – MP158
Crash / Injury & Fatal (2017)	2 / 1
# of unsignalized intersections	2
# of signalized intersections	0

After running USLIMITS2 for location 1 in Salina City, the recommended speed limit is 55 mph. That is 15 mph more than the existing speed limit.

4.30 Kanab City

US-89 passes through Kanab City, and there are speed-limit changes on both the north and east entrances of the city, as shown in **Figure 33**.

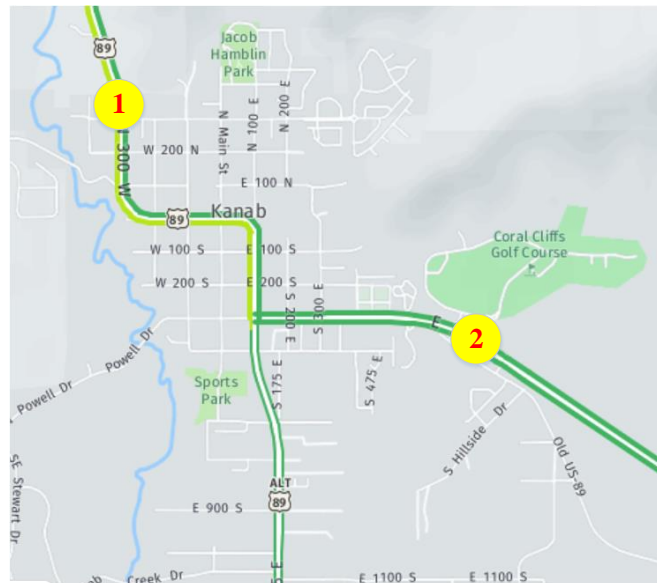


Figure 33 Selected locations in Kanab City

Location 1

Location 1 is on southbound US-89, and the speed limit changes from 55 mph to 35 mph. The data of location 1 for USLIMITS2 are shown in **Table 64**.

Table 64 Data of location 1 in Kanab City

AADT	2139
85th percentile speed	55 mph
50th percentile speed	52 mph
Speed limit	35 mph
Study segment	MP65.2 – MP64.7
Crash / Injury & Fatal (2017)	3 / 1
# of unsignalized intersections	3
# of signalized intersections	0

Location 2

Location 2 is on westbound US-89, and the speed limit changes from 65 mph to 45 mph. The data of location 2 for USLIMITS2 are shown in **Table 65**.

Table 65 Data of location 2 in Kanab City

AADT	1878
85th percentile speed	55 mph
50th percentile speed	53 mph
Speed limit	45 mph
Study segment	MP62.8 – MP63.3
Crash / Injury & Fatal (2017)	4 / 1
# of unsignalized intersections	3
# of signalized intersections	0

After running USLIMITS2 for both locations in Kanab City, the results are shown in **Table 66**. For location 1, the recommended speed limit is 55 mph. That is 20 mph higher than the existing speed limit. For location 2, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit.

Table 66 Recommended speed limit for two locations in Kanab City

Location	Existing Speed Limit	Recommended Speed Limit
Location 1	35 mph	55 mph
Location 2	45 mph	55 mph

4.31 Koosharem Town

SR-62 passes through Koosharem Town, and there are speed-limit changes on both the north and south entrances of the town, as shown in **Figure 34**.

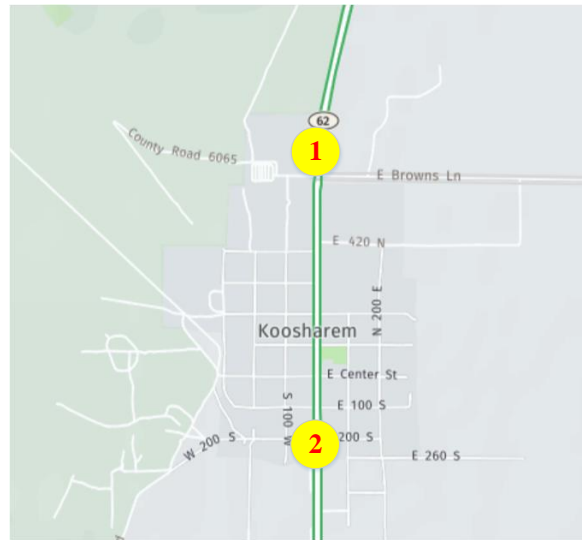


Figure 34 Selected locations in Koosharem Town

Location 1

Location 1 is on southbound SR-62, and the speed limit changes from 60 mph to 50 mph. The data of location 1 for USLIMITS2 are shown in **Table 67**.

Table 67 Data of location 1 in Koosharem Town

AADT	213
85th percentile speed	57 mph
50th percentile speed	52 mph
Speed limit	50 mph
Study segment	MP38.8 – MP38.3
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	4
# of signalized intersections	0

Location 2

Location 2 is on westbound SR-62, and the speed limit changes from 55 mph to 40 mph. The data of location 2 for USLIMITS2 are shown in **Table 68**.

Table 68 Data of location 2 in Koosharem Town

AADT	183
85th percentile speed	51 mph
50th percentile speed	49 mph
Speed limit	40 mph
Study segment	MP37.2 – MP37.7
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	3
# of signalized intersections	0

After running USLIMITS2 for both locations in Koosharem Town, the results are shown in **Table 69**. For location 1, the recommended speed limit is 55 mph. That is 5 mph higher than the existing speed limit. For location 2, the recommended speed limit is 50 mph. That is 10 mph higher than the existing speed limit.

Table 69 Recommended speed limit for two locations in Koosharem Town

Location	Existing Speed Limit	Recommended Speed Limit
Location 1	50 mph	55 mph
Location 2	40 mph	50 mph

4.32 Bicknell Town

SR-24 passes through Bicknell Town, and there are speed-limit changes on both the north and south entrances to the town, as shown in **Figure 35**.

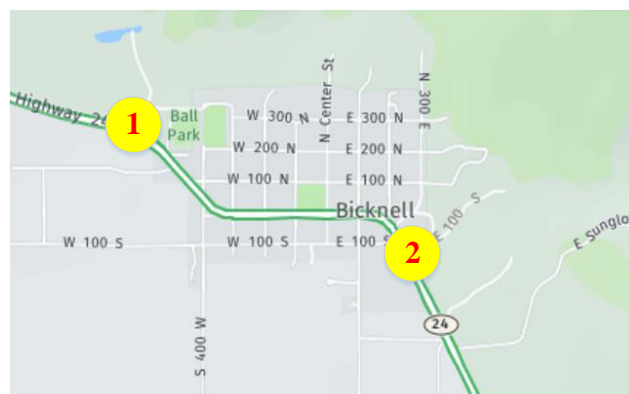


Figure 35 Selected locations in Bicknell Town

Location 1

Location 1 is on southbound SR-24, and the speed limit changes from 65 mph to 30 mph. The data of location 1 for USLIMITS2 are shown in **Table 70**.

Table 70 Data of location 1 in Bicknell Town

AADT	1260
85 th percentile speed	50 mph
50 th percentile speed	48 mph
Speed limit	30 mph
Study segment	MP59.5 – MP60
Crash / Injury & Fatal (2017)	3 / 0
# of unsignalized intersections	4
# of signalized intersections	0

Location 2

Location 2 is on northbound SR-24, and the speed limit changes from 50 mph to 30 mph. The data of location 2 for USLIMITS2 are shown in **Table 71**.

Table 71 Data of location 2 in Bicknell Town

AADT	975
85 th percentile speed	48 mph
50 th percentile speed	47 mph
Speed limit	30 mph
Study segment	MP61 – MP60.5
Crash / Injury & Fatal (2017)	1 / 1
# of unsignalized intersections	4
# of signalized intersections	0

After running USLIMITS2 for both locations in Bicknell Town, the results are shown in **Table 72**. For location 1, the recommended speed limit is 50 mph. That is 20 mph higher than the existing speed limit. For location 2, the recommended speed limit is 45 mph. That is 15 mph higher than the existing speed limit.

Location 2

Location 2 is on northbound SR-12, and the speed limit changes from 60 mph to 40 mph. The data of location 2 for USLIMITS2 are shown in **Table 74**.

Table 74 Data of location 2 in Escalante City

AADT	582
85th percentile speed	50 mph
50th percentile speed	48 mph
Speed limit	40 mph
Study segment	MP61 – MP60.5
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	3
# of signalized intersections	0

After running USLIMITS2 for both locations in Escalante City, the results are shown in **Table 75**. For location 1, the recommended speed limit is 45 mph. That is 5 mph higher than the existing speed limit. For location 2, the recommended speed limit is 50 mph. That is 10 mph higher than the existing speed limit.

Table 75 Recommended speed limit for two locations in Escalante City

Location	Existing Speed Limit	Recommended Speed Limit
Location 1	40 mph	45 mph
Location 2	40 mph	50 mph

4.34 Huntington City

SR-10 and SR-31 pass through Huntington City, and there are speed limit changes on all three entrances of the city, as shown in **Figure 37**.

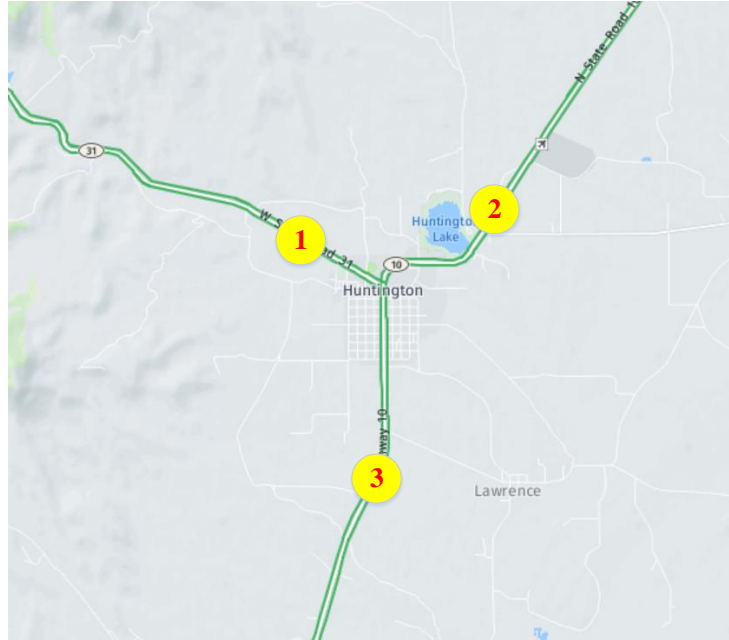


Figure 37 Selected locations in Huntington City

Location 1

Location 1 is on southbound SR-31, and the speed limit changes from 50 mph to 40 mph. The data of location 1 for USLIMITS2 are shown in **Table 76**.

Table 76 Data of location 1 in Huntington City

AADT	3222
85th percentile speed	46 mph
50th percentile speed	45 mph
Speed limit	40 mph
Study segment	MP46.8 – MP47.3
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	2
# of signalized intersections	0

Location 2

Location 2 is on southbound SR-10, and the speed limit changes from 65 mph to 45 mph. The data of location 2 for USLIMITS2 are shown in **Table 77**.

Table 77 Data of location 2 in Huntington City

AADT	3687
85th percentile speed	49 mph
50th percentile speed	47 mph
Speed limit	45 mph
Study segment	MP49 – MP48
Crash / Injury & Fatal (2017)	3 / 0
# of unsignalized intersections	1
# of signalized intersections	0

Location 3

Location 3 is on southbound SR-10, and the speed limit changes from 65 mph to 45 mph. The data of location 3 for USLIMITS2 are shown in **Table 78**.

Table 78 Data of location 3 in Huntington city

AADT	3573
85th percentile speed	56 mph
50th percentile speed	54 mph
Speed limit	45 mph
Study segment	MP46 – MP46.8
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	4
# of signalized intersections	0

After running USLIMITS2 for the three locations in Huntington City, the results are shown in **Table 79**. For location 1, the recommended speed limit is 45 mph. That is 5 mph higher than the existing speed limit. For location 2, the recommended speed limit is 50 mph. That is 5 mph higher than the existing speed limit. For location 3, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit.

Table 79 Recommended speed limit for three locations in Huntington City

Location	Existing Speed Limit	Recommended Speed Limit
Location 1	40 mph	45 mph
Location 2	45 mph	50 mph
Location 3	45 mph	55 mph

4.35 Ferron City

SR-10 passes through Ferron City, and there are speed-limit changes on both the north and south entrances of the city, as shown in **Figure 38**.

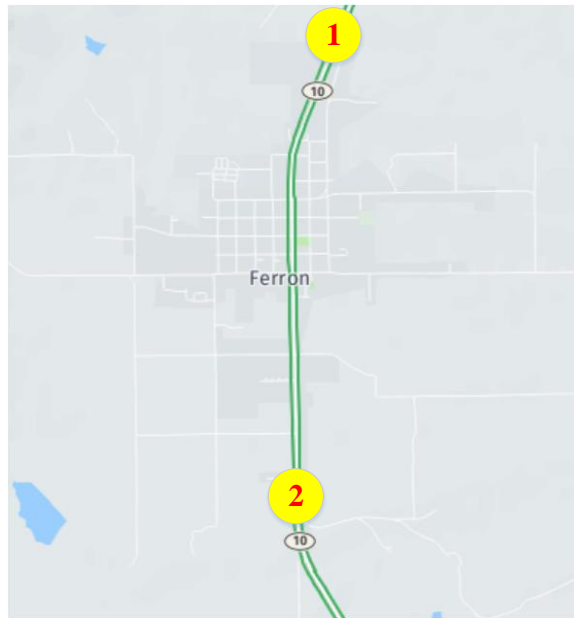


Figure 38 Selected locations in Ferron City

Location 1

Location 1 is on southbound SR-10, and the speed limit changes from 65 mph to 45 mph. The data of location 1 for USLIMITS2 are shown in **Table 80**.

Table 80 Data of location 1 in Ferron City

AADT	2793
85th percentile speed	58 mph
50th percentile speed	56 mph
Speed limit	45 mph
Study segment	MP28.5 – MP27.5
Crash / Injury & Fatal (2017)	2 / 1
# of unsignalized intersections	3
# of signalized intersections	0

Location 2

Location 2 is on northbound SR-10, and the speed limit changes from 65 mph to 55 mph. The data of location 2 for USLIMITS2 are shown in Table 81.

Table 81 Data of location 2 in Ferron City

AADT	2793
85th percentile speed	58 mph
50th percentile speed	55 mph
Speed limit	55 mph
Study segment	MP24.5 – MP25.5
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	2
# of signalized intersections	0

After running USLIMITS2 for both locations in Ferron City, the results are shown in Table 82. For location 1, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit. For location 2, the recommended speed limit is 55 mph. That is the same as the existing speed limit.

Table 82 Recommended speed limit for 2 locations in Ferron City

Location	Existing Speed Limit	Recommended Speed Limit
Location 1	45 mph	55 mph
Location 2	55 mph	55 mph

4.36 Emery Town

SR-10 passes through Emery Town, and there are speed-limit changes on both the north and west entrances of the town, as shown in Figure 39.

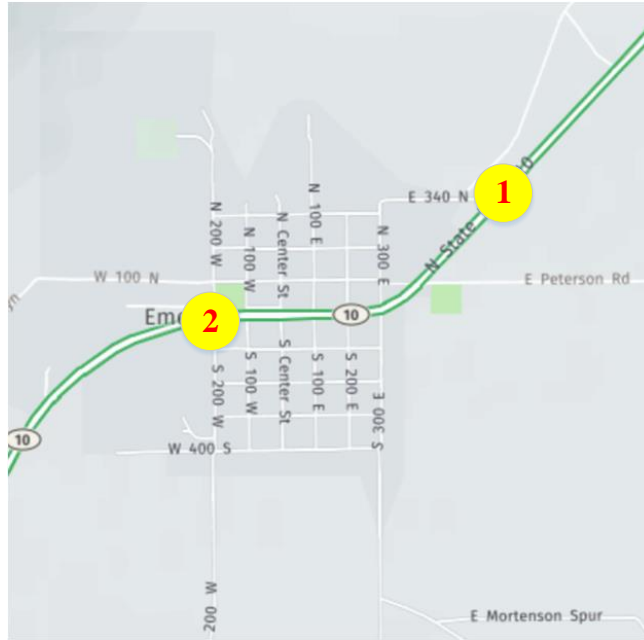


Figure 39 Selected locations in Emery Town

Location 1

Location 1 is on southbound SR-10, and the speed limit changes from 65 mph to 45 mph. The data of location 1 for USLIMITS2 are shown in **Table 83**.

Table 83 Data of location 1 in Emery Town

AADT	1830
85th percentile speed	60 mph
50th percentile speed	57 mph
Speed limit	45 mph
Study segment	MP13.5 – MP13
Crash / Injury & Fatal (2017)	1 / 0
# of unsignalized intersections	2
# of signalized intersections	0

Location 2

Location 2 is on northbound SR-10, and the speed limit changes from 65 mph to 35 mph. The data of location 2 for USLIMITS2 are shown in **Table 84**.

Table 84 Data of location 2 in Emery Town

AADT	1827
85th percentile speed	60 mph
50th percentile speed	58 mph
Speed limit	35 mph
Study segment	MP12 – MP12.5
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	2
# of signalized intersections	0

After running USLIMITS2 for both locations in Emery Town, the results are shown in **Table 85**. For location 1, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit. For location 2, the recommended speed limit is 55 mph. That is the same as the existing speed limit.

Table 85 Recommended speed limit for two locations in Emery Town

Location	Existing Speed Limit	Recommended Speed Limit
Location 1	45 mph	55 mph
Location 2	35 mph	55 mph

4.37 Monticello City

US-191 and US-491 pass through Monticello City, and there are speed-limit changes on all three entrances of the city, as shown in **Figure 40**.

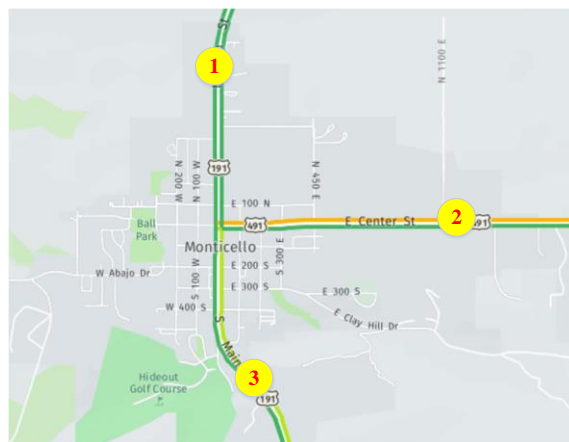


Figure 40 Selected locations in Monticello City

Location 1

Location 1 is on southbound US-191, and the speed limit changes from 65 mph to 40 mph. The data of location 1 for USLIMITS2 are shown in **Table 86**.

Table 86 Data of location 1 in Monticello City

AADT	2319
85 th percentile speed	60 mph
50 th percentile speed	58 mph
Speed limit	40 mph
Study segment	MP73 – MP72.5
Crash / Injury & Fatal (2017)	3 / 0
# of unsignalized intersections	3
# of signalized intersections	0

Location 2

Location 2 is on northbound US-491, and the speed limit changes from 55 mph to 40 mph. The data of location 2 for USLIMITS2 are shown in **Table 87**.

Table 87 Data of location 2 in Monticello City

AADT	1575
85 th percentile speed	60 mph
50 th percentile speed	59 mph
Speed limit	40 mph
Study segment	MP1.5 – MP1
Crash / Injury & Fatal (2017)	3 / 0
# of unsignalized intersections	3
# of signalized intersections	0

Location 3

Location 3 is on northbound SR-10, and the speed limit changes from 55 mph to 45 mph. The data of location 3 for USLIMITS2 are shown in **Table 88**.

Table 88 Data of location 3 in Monticello City

AADT	1788
85th percentile speed	55 mph
50th percentile speed	52 mph
Speed limit	45 mph
Study segment	MP70.8 – MP71.3
Crash / Injury & Fatal (2017)	2 / 0
# of unsignalized intersections	2
# of signalized intersections	0

After running USLIMITS2 for the three locations in Monticello City, the results are shown in **Table 89**. For location 1, the recommended speed limit is 55 mph. That is 15 mph higher than the existing speed limit. For location 2, the recommended speed limit is 55 mph. That is 15 mph higher than the existing speed limit. For location 3, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit.

Table 89 Recommended speed limit for three locations in Monticello City

Location	Existing Speed Limit	Recommended Speed Limit
Location 1	40 mph	55 mph
Location 2	40 mph	55 mph
Location 3	45 mph	55 mph

4.38 Blanding City

US-191 passes through Blanding City, and there are speed-limit changes on both entrances of the city, as shown in **Figure 41**.

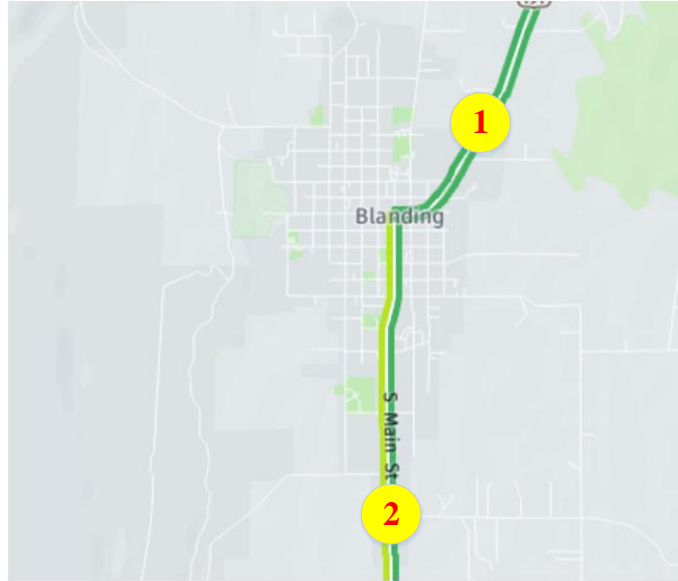


Figure 41 Selected locations in Blanding City

Location 1

Location 1 is on southbound US-191, and the speed limit changes from 50 mph to 45 mph. The data of location 1 for USLIMITS2 are shown in **Table 90**.

Table 90 Data of location 1 in Blanding City

AADT	1788
85th percentile speed	55 mph
50th percentile speed	52 mph
Speed limit	45 mph
Study segment	MP52.2 – MP51.7
Crash / Injury & Fatal (2017)	0 / 0
# of unsignalized intersections	4
# of signalized intersections	0

Location 2

Location 2 is on northbound US-191, and the speed limit changes from 65 mph to 45 mph. The data of location 2 for USLIMITS2 are shown in **Table 91**.

Table 91 Data of location 2 in Blanding City

AADT	1788
85th percentile speed	55 mph
50th percentile speed	52 mph
Speed limit	45 mph
Study segment	MP49 – MP50
Crash / Injury & Fatal (2017)	2 / 0
# of unsignalized intersections	2
# of signalized intersections	0

After running USLIMITS2 for both locations in Blanding City, the results are shown in **Table 92**. For location 1, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit. For location 2, the recommended speed limit is 55 mph. That is 10 mph higher than the existing speed limit.

Table 92 Recommended speed limit for two locations in Blanding City

Location	Existing Speed Limit	Recommended Speed Limit
Location 1	45 mph	55 mph
Location 2	45 mph	55 mph

5. RESULT ANALYSIS AND COUNTERMEASURES

5.1 Overview

The recommended speed limits were obtained by implementing the USLIMITS2 for each of the small cities or towns in Utah. The 85th percentile speeds at some locations are higher than 60 mph so the USLIMITS2 cannot be adopted for analysis. All other locations were studied and recommended speed limits were obtained. Three types of cases were found:

- The recommended speed limit is lower than the existing speed limit;
- The recommended speed limit is higher than the existing speed limit;
- The recommended speed limit equals the existing speed limit.

Notably, further investigations are needed for the first and second types of cases to identify potential factors that caused the higher and lower speed limits.

5.2 Locations with 85th Percentile Speed Higher than 60 mph

Table 93 presents the 85th percentile speeds of 9 locations which are higher than 60 mph. At those locations, the detected speeds are much higher than the existing speed limit, e.g., more than 50% of the speed limit in some cases. This brings high potential risks to traffic safety at the entrances of those small towns and cities. Transportation agencies should take effective actions to control the traffic speeds at these locations. For example, speed limit signs should be placed on more visible sites or enhanced with flashing lights.

Table 93 85th percentile speed higher than 60 mph

Town / City	Location	85 th percentile speed (mph)	Existing speed (mph)
Woodruff Town	Location 1	61	40
Cedar Fort Town	Location 1	63	50
Duchesne City	Location 1	61	40
Duchesne City	Location 2	61	40
Vernal City	Location 1	61	40
Milford City	Location 1	62	30

Cedar City	Location 1	63	55
Hildale City	Location 1	64	40
Gunnison City	Location 2	63	30

5.3 Recommended Speed Limit from USLIMITS2 is Lower than the Existing Speed Limit

After implementing the USLIMITS2 for all selected locations, the recommended speed limits of four locations are lower than the existing speed limits, as shown in **Table 94**. Three of them have relative high crash rates compared with the others. The AADTs of all four locations are also high. The 85th percentile speeds of three locations are closer to the recommended speed limits. Hence, a conclusion can be reached that the speed limits should be decreased at the entrances of those small cities or towns with high AADT, low 85th percentile speed, and high crash rate.

Table 94 Recommended Speed Limit is Lower than the Existing Speed Limit

Town / City	Location	Existing speed (mph)	Recommended speed (mph)	Crash (total/ injured)	AADT	85 th percentile speed
Tooele City	Location 2	50	40	21/ 10	13314	44
Tooele City	Location 3	55	50	12 / 2	3897	53
Santaquin City	Location 2	45	40	10 / 1	3417	47
Nephi City	Location 3	45	40	2 / 0	4497	41

5.4 Recommended Speed Limit from USLIMITS 2 is Higher than the Existing Speed Limit

In the meantime, the recommended speed limits of 46 locations are higher than the existing speed limits, as shown in **Table 95**. The AADTs of 40 locations are lower by 3000 vehicles/day. Most locations with lower crash rates could obtain higher recommended speed limits. The 85th percentile speeds of all locations are higher than the existing speed limits. In other words, the recommended speed limits are closer to the 85th percentile speed for all locations. Hence, a conclusion can be reached that the speed limit could be potentially increased at the locations if necessary.

Table 95 Recommended Speed Limit is Higher than the Existing Speed Limit

Town / City	Location	Existing speed	Recommended speed	AADT	85th percentile speed	Crash (total/ injured)
Garden city	location 1	40	45	1263	45	0/0
Randolph city	location 2	40	55	1275	60	0/0
Woodruff town	location 2	40	50	735	56	2 / 0
Grantsville city	location 1	40	50	3444	53	0/0
Santaquin city	location 1	35	50	2583	52	2 / 1
Eureka city	location 1	30	40	687	42	0 / 0
Eureka city	location 2	30	40	684	41	1 / 0
Kamas city	location 1	35	40	2160	43	2 / 1
Heber city	location 1	35	45	12513	48	15 / 3
Roosevelt city	location 1	35	45	5793	35	9 / 2
Delta city	location 1	45	55	1686	54	0 / 0
Nephi city	location 1	35	40	1521	40	0 / 0
Nephi city	location 2	45	50	1890	53	7 / 1
Nephi city	location 4	45	55	1152	59	1 / 0
Levan town	location 1	35	55	426	57	0 / 0
Levan town	location 2	35	45	1389	49	1 / 0
Levan town	location 3	35	55	1131	60	2 / 1
Scipio town	location 1	35	55	1989	60	0 / 0
Beaver city	location 1	35	50	885	53	1 / 0
Milford city	location 2	45	50	534	49	0 / 0
Cedar city	location 2	30	40	1377	44	18 / 5
Fairview city	location 1	35	45	2154	52	4 / 1
Moroni city	location 1	40	55	1842	57	1 / 0
Moroni city	location 2	30	45	1437	47	1 / 0
Moroni city	location 3	40	50	1398	51	0 / 0
Manti city	location 2	45	55	3681	50	6 / 1
Salina city	location 1	40	55	1980	56	2 / 1
Kanab city	location 1	35	55	2139	55	3 / 1
Kanab city	location 2	45	55	1878	55	4 / 1
Koosharem town	location 1	50	55	213	57	0 / 0
Koosharem town	location 2	40	50	183	51	0 / 0

Bicknell town	location 1	30	50	1260	50	3 / 0
Bicknell town	location 2	30	45	975	48	1 / 1
Escalante city	location 1	40	45	519	45	0 / 0
Escalante city	location 2	40	50	582	50	1 / 0
Huntington city	location 1	40	45	3222	46	0 / 0
Huntington city	location 2	45	50	3687	49	3 / 0
Huntington city	location 3	45	55	3573	56	0 / 0
Ferron city	location 1	45	55	2793	58	2 / 1
Emery town	location 1	45	55	1830	60	1 / 0
Emery town	location 2	35	55	1827	60	0 / 0
Monticello city	location 1	40	55	2319	60	3 / 0
Monticello city	location 2	40	55	1575	60	3 / 0
Monticello city	location 3	45	55	1788	55	2 / 0
Blanding city	location 1	45	55	1788	55	0 / 0
Blanding city	location 2	45	55	1788	55	2 / 0

5.5 The 85th Percentile Speed Changes of Adjacent Small Cities/Towns

Based on the case studies, the 85th percentile speed changes of adjacent small cities/towns are also investigated in this study.

5.5.1 Randolph City and Woodruff Town along SR-16

Randolph City and Woodruff Town are close to each other along state highway SR-16, as shown in **Figure 42**. The 85th percentile speeds of both locations are shown in **Table 96**, which indicates that drivers behaved similarly when entering the two towns.

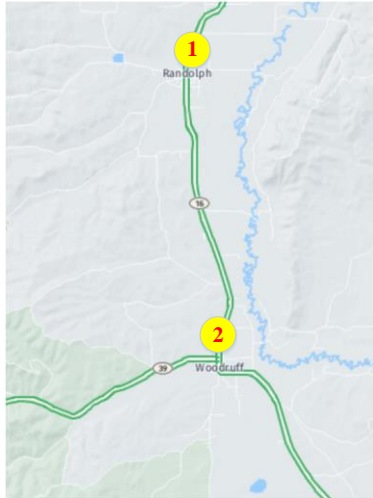


Figure 42 Locations for 85th percentile speed in Randolph City and Woodruff Town

Table 96 85th percentile speed of the entrance of Randolph City and Woodruff Town

Location	85 th percentile speed
Location 1	60 mph
Location 2	61 mph

5.5.2 Ephraim City and Manti City along US-89

Ephraim City and Manti City are close to each other along state highway US-89, as shown in **Figure 43**. The 85th percentile speeds of both locations are shown in **Table 97**. Based on the results, there is a 10-mph speed difference when drivers entered Ephraim City and Manti City.

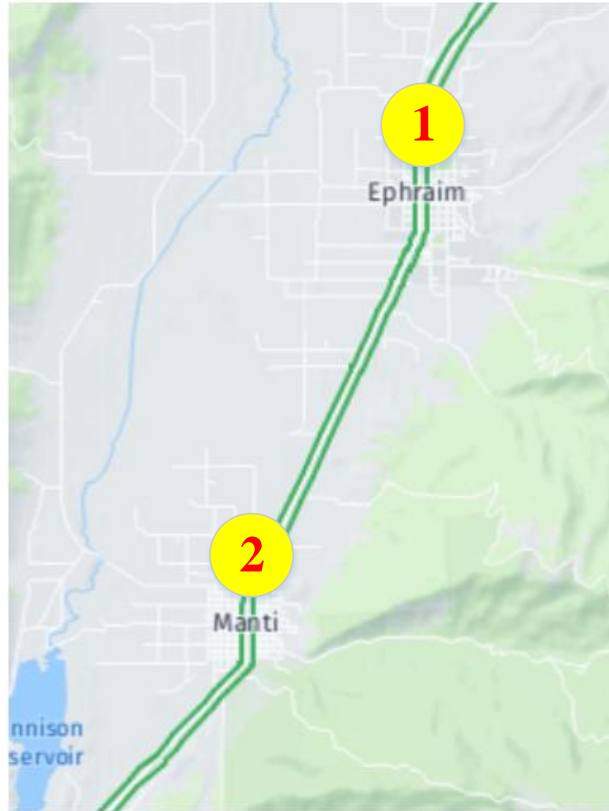


Figure 43 Locations for 85th percentile speed on Ephraim City and Manti City

Table 97 85th percentile speed of the entrance of Ephraim City and Manti City

Location	85 th percentile speed
Location 1	49 mph
Location 2	59 mph

5.4.3 Ferron City and Emery City along SR-10

Ferron City and Emery City are adjacent along state highway SR-10, as shown in **Figure 44**. The 85th percentile speeds of both locations are shown in **Table 98**, and there is only a 2-mph speed difference. Drivers behaved similarly when entering the two cities.

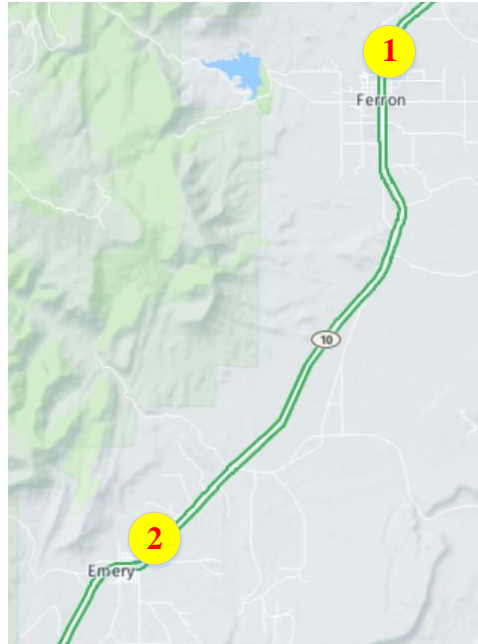


Figure 44 Locations for 85th percentile speed in Ferron City and Emery City

Table 98 85th percentile speed of the entrance of Ferron City and Emery City

Location	85 th percentile speed
Location 1	58 mph
Location 2	60 mph

5.4.4 Monticello City and Blanding City along US-191

Monticello City and Blanding City are adjacent along state highway US-191, as shown in **Figure 43**. The 85th percentile speeds of both locations are shown in **Table 97**. A 5-mph 85th percentile speed change can be observed here.

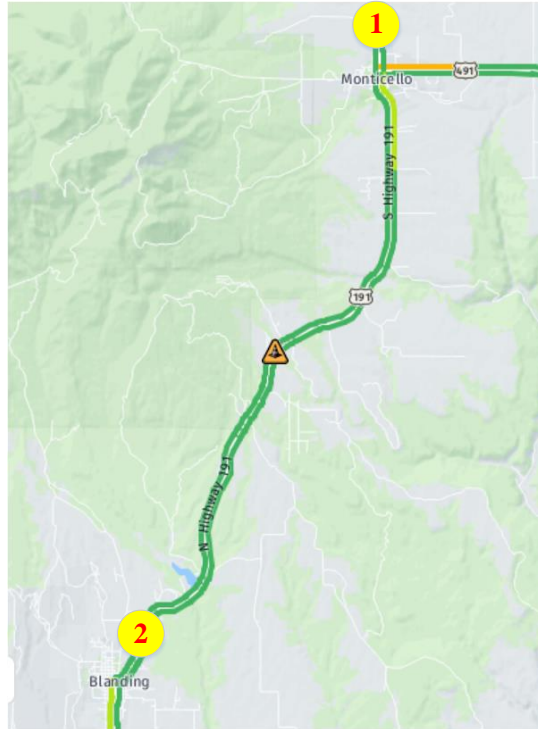


Figure 45 Locations for 85th percentile speed in Monticello City and Blanding City

Table 99 85th percentile speed of the entrance of Monticello City and Blanding City

Location	85 th percentile speed
Location 1	60 mph
Location 2	55 mph

6. CONCLUSIONS

6.1 Summary

In this project, our research team applied USLIMITS2 to obtain the appropriate maximum speed limit for the studied road segments of small cities and towns in Utah. USLIMITS2 employed a decision algorithm to advise the user of the appropriate maximum speed limit for the specific road section of interest. Different data sources were utilized for this research, such as the iPeMS database, the Utah Vehicle Collisions Database, etc. USLIMITS2 was implemented in evaluating the speed limit designs of 38 small cities and towns in Utah.

6.2 Findings

The results showed that the 85th percentile speeds of 9 studied locations are more than 60 mph. The recommended speed limits of 46 locations of these small cities and towns are higher than the existing speed limits. The recommended speed limits of 4 locations are lower than the existing speed limits. Transportation agencies should take action to control traffic speed if the highway 85th percentile speed at the entrances of those small cities or towns are higher than 60 mph as it can bring high crash risks. It is also recommended that the speed limits should be decreased at the entrances of the small cities or towns with high AADT, low 85th percentile speed, and high crash rate.

6.3 Limitations and Challenges

Data quality has a significant effect on the results of USLIMITS2. It should be noted that data may not be accurate enough at some studied locations, such as the AADT and crash records. Also, this study lacks field observation for every location due to budget limitations. Future field studies would be helpful for better speed limit designs and evaluations.

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APPENDIX

Appendix 1

USLIMITS2 Speed Zoning Report for Location 1 in Nephi City

Project Name: Speed Limit Project

Analyst: Zhao Zhang

Date: 09-22-2019

Basic Project Information

Project Number: 123456

Route Name: UT-132

From: MP32.5

To: MP33

State: Utah

County: Juab County

City: Nephi City

Route Type: Road Section in Developed Area

Route Status: Existing

Crash Data Information

Crash Data Years: 1.00

Crash AADT: 1521 veh/day

Total Number of Crashes: 0

Total Number of Injury Crashes: 0

Section Crash Rate: 0 per 100 MVM

Section Injury Crash Rate: 0 per 100 MVM

Crash Rate Average for Similar Roads: 292

Injury Rate Average for Similar Roads: 72

Roadway Information

Section Length: 0.5 mile(s)

Statutory Speed Limit: 35 mph

Traffic Information

85th Percentile Speed: 40 mph

50th Percentile Speed: 38 mph

AADT: 1521 veh/day

Existing Speed Limit: 35 mph

On Street Parking and Usage: Not High

Adverse Alignment: Yes

Pedestrian / Bicyclist Activity: Not High

One-Way Street: No

Divided/Undivided: Divided

Number of Through Lanes: 2

Area Type: Residential-Collector/Arterial

Number of Driveways: 3

Number of Signals: 0

Recommended Speed Limit: **40**

Note: The final recommended speed limit is higher than the 35 mph statutory speed limit for this type of road. An engineering study such as the one carried out with USLIMITS is usually required to set a speed limit above the statutory limit.

Note: Sections with adverse alignments may need specific 'advisory speed warnings' which may be different from the general speed limit for the section. See [Procedures for Setting Advisory Speeds on Curves](#), Publication No. FHWA-SA-11-22, June 2011, for more guidance.

Disclaimer: The U.S. Government assumes no liability for the use of the information contained in this report. This report does not constitute a standard, specification, or regulation.

Equations Used in Crash Data Calculations

Exposure (M)

$$M = (\text{Section AADT} * 365 * \text{Section Length} * \text{Duration of Crash Data}) / (100000000)$$

$$M = (1521 * 365 * 0.5 * 1.00) / (100000000)$$

$$M = 0.0028$$

Crash Rate (Rc)

$$Rc = (\text{Section Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$$

$$Rc = (0.00 * 100000000) / (1521 * 365 * 0.5)$$

$$Rc = 0.00 \text{ crashes per 100 MVM}$$

Injury Rate (Ri)

$$Ri = (\text{Section Injury Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$$

$$Ri = (0.00 * 100000000) / (1521 * 365 * 0.5)$$

$$Ri = 0.00 \text{ injuries per 100 MVM}$$

Critical Crash Rate (Cc)

$$Cc = \text{Crash Average of Similar Sections} + 1.645 * (\text{Crash Average of Similar Sections} / \text{Exposure}) ^ {(1/2) + (1 / (2 * \text{Exposure}))}$$

$$Cc = 292.23 + 1.645 * (292.23 / 0.0028) ^ {(1/2) + (1 / (2 * 0.0028))}$$

$$Cc = 1006.09 \text{ crashes per 100 MVM}$$

Critical Injury Rate (Ic)

$Ic = \text{Injury Crash Average of Similar Sections} + 1.645 * (\text{Injury Crash Average of Similar Sections} / \text{Exposure})^{(1/2)} + (1 / (2 * \text{Exposure}))$

$Ic = 72.30 + 1.645 * (72.30 / 0.0028)^{(1/2)} + (1 / (2 * 0.0028))$

$Ic = 517.91$ injuries per 100 MVM

Appendix 2

USLIMITS2 Speed Zoning Report for Location 1 in Park City

Project Name: Speed Limit Project

Analyst: Zhao Zhang

Date: 09-22-2019

Basic Project Information

Project Number: 123456

Route Name: UT-248

From: MP1.5

To: MP1

State: Utah

County: Summit County

City: Park City

Route Type: Road Section in Developed Area

Route Status: Existing

Roadway Information

Crash Data Information

Crash Data Years: 1.00

Crash AADT: 10818 veh/day

Total Number of Crashes: 11

Total Number of Injury Crashes: 2

Section Crash Rate: 557 per 100 MVM

Section Injury Crash Rate: 101 per 100 MVM

Crash Rate Average for Similar Roads: 252

Injury Rate Average for Similar Roads: 75

Traffic Information

85th Percentile Speed: 39 mph

Section Length: 0.5 mile(s)

50th Percentile Speed: 33 mph

Statutory Speed Limit: 35 mph

AADT: 10818 veh/day

Existing Speed Limit: 35 mph

On Street Parking and Usage: Not High

Adverse Alignment: Yes

Pedestrian / Bicyclist Activity: Not High

One-Way Street: No

Divided/Undivided: Divided

Number of Through Lanes: 2

Area Type: Residential-Collector/Arterial

Number of Driveways: 3

Number of Signals: 1

Recommended Speed Limit: **35**

Note: Sections with adverse alignments may need specific 'advisory speed warnings' which may be different from the general speed limit for the section. See Procedures for Setting Advisory Speeds on Curves, Publication No. FHWA-SA-11-22, June 2011, for more guidance.

Note: The section crash rate of 557 per 100 MVM is above the critical rate (463). The injury crash rate for the section of 101 per 100 MVM is more than 30 percent above the average for similar roads (75) but below the critical rate (202). A comprehensive crash study should be undertaken to identify engineering and traffic control deficiencies and appropriate corrective actions. The speed limit should only be reduced as a last measure after all other treatments have either been tried or ruled out.

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Equations Used in Crash Data Calculations

Exposure (M)

$M = (\text{Section AADT} * 365 * \text{Section Length} * \text{Duration of Crash Data}) / (100000000)$

$M = (10818 * 365 * 0.5 * 1.00) / (100000000)$

$M = 0.0197$

Crash Rate (Rc)

$Rc = (\text{Section Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$

$Rc = (11.00 * 100000000) / (10818 * 365 * 0.5)$

$Rc = 557.16 \text{ crashes per 100 MVM}$

Injury Rate (Ri)

$R_i = (\text{Section Injury Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$

$R_i = (2.00 * 100000000) / (10818 * 365 * 0.5)$

$R_i = 101.30$ injuries per 100 MVM

Critical Crash Rate (Cc)

$C_c = \text{Crash Average of Similar Sections} + 1.645 * (\text{Crash Average of Similar Sections} / \text{Exposure}) ^{(1/2)} + (1 / (2 * \text{Exposure}))$

$C_c = 251.63 + 1.645 * (251.63 / 0.0197) ^{(1/2)} + (1 / (2 * 0.0197))$

$C_c = 462.66$ crashes per 100 MVM

Critical Injury Rate (Ic)

$I_c = \text{Injury Crash Average of Similar Sections} + 1.645 * (\text{Injury Crash Average of Similar Sections} / \text{Exposure}) ^{(1/2)} + (1 / (2 * \text{Exposure}))$

$I_c = 75.09 + 1.645 * (75.09 / 0.0197) ^{(1/2)} + (1 / (2 * 0.0197))$

$I_c = 201.86$ injuries per 100 MVM

Appendix 3

USLIMITS2 Speed Zoning Report for Location 2 in Kanab City

Project Name: Speed Limit Project

Analyst: Zhao Zhang

Date: 09-28-2018

Basic Project Information

Project Number: 123456

Route Name: US-89

From: MP62.8

To: MP63.3

State: Utah

County: Kane County

City: Kanab City

Crash Data Information

Crash Data Years: 1.00

Crash AADT: 1878 veh/day

Total Number of Crashes: 4

Total Number of Injury Crashes: 1

Section Crash Rate: 1167 per 100 MVM

Section Injury Crash Rate: 292 per 100 MVM

Crash Rate Average for Similar Roads: 292

Route Type: Road Section in Developed Area

Injury Rate Average for Similar Roads: 72

Route Status: Existing

Traffic Information

Roadway Information

85th Percentile Speed: 55 mph

Section Length: 0.5 mile(s)

50th Percentile Speed: 53 mph

Statutory Speed Limit: 45 mph

AADT: 1878 veh/day

Existing Speed Limit: 45 mph

On Street Parking and Usage: Not High

Adverse Alignment: Yes

Pedestrian / Bicyclist Activity: Not High

One-Way Street: No

Divided/Undivided: Divided

Number of Through Lanes: 2

Area Type: Residential-Collector/Arterial

Number of Driveways: 3

Number of Signals: 0

Recommended Speed Limit: 55

Note: The final recommended speed limit is higher than the 45 mph statutory speed limit for this type of road. An engineering study such as the one carried out with USLIMITS is usually required to set a speed limit above the statutory limit.

Note: Sections with adverse alignments may need specific 'advisory speed warnings' which may be different from the general speed limit for the section. See Procedures for Setting Advisory Speeds on Curves, Publication No. FHWA-SA-11-22, June 2011, for more guidance.

Note: The section crash rate of 1167 per 100 MVM is above the critical rate (918). The injury crash rate for the section of 292 per 100 MVM is more than 30 percent above the average for similar roads (72) but below the critical rate (457). A comprehensive crash study should be undertaken to identify engineering and traffic control deficiencies and appropriate corrective actions. The speed limit should only be reduced as a last measure after all other treatments have either been tried or ruled out.

Note: A speed zone of 0.5 miles is generally too short for the recommended speed limit. Consider lengthening the speed zone (if that is possible) or using the speed limits from adjacent sections (if they are appropriate for this section). If the speed and other data you provided are representative of conditions for this short section, then the speed limit noted above may be considered. If the data were taken in an area with adverse horizontal and vertical alignment or unique geometric and/or traffic control features, then the above-noted speed limit may not be appropriate because this expert system is not designed to recommend speed limits for sharp horizontal curves or in other special traffic situations.

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Equations Used in Crash Data Calculations

Exposure (M)

$$M = (\text{Section AADT} * 365 * \text{Section Length} * \text{Duration of Crash Data}) / (100000000)$$

$$M = (1878 * 365 * 0.5 * 1.00) / (100000000)$$

$$M = 0.0034$$

Crash Rate (Rc)

$$Rc = (\text{Section Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$$

$$Rc = (4.00 * 100000000) / (1878 * 365 * 0.5)$$

$$Rc = 1167.08 \text{ crashes per 100 MVM}$$

Injury Rate (Ri)

$$Ri = (\text{Section Injury Crash Average} * 100000000) / (\text{Section AADT} * 365 * \text{Section Length})$$

$$Ri = (1.00 * 100000000) / (1878 * 365 * 0.5)$$

$$Ri = 291.77 \text{ injuries per 100 MVM}$$

Critical Crash Rate (Cc)

$$Cc = \text{Crash Average of Similar Sections} + 1.645 * (\text{Crash Average of Similar Sections} / \text{Exposure}) ^{(1/2)} + (1 / (2 * \text{Exposure}))$$

$$Cc = 292.23 + 1.645 * (292.23 / 0.0034) ^{(1/2)} + (1 / (2 * 0.0034))$$

$$Cc = 918.45 \text{ crashes per 100 MVM}$$

Critical Injury Rate (Ic)

$$Ic = \text{Injury Crash Average of Similar Sections} + 1.645 * (\text{Injury Crash Average of Similar Sections} / \text{Exposure}) ^{(1/2)} + (1 / (2 * \text{Exposure}))$$

$$Ic = 72.30 + 1.645 * (72.30 / 0.0034) ^{(1/2)} + (1 / (2 * 0.0034))$$

$$Ic = 457.11 \text{ injuries per 100 MVM}$$